

THE
INDIAN FORESTER.
A MONTHLY MAGAZINE
OF
FORESTRY,
AGRICULTURE, SHIKAR & TRAVEL.

EDITED BY
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VOL. XXV. (1899).

Milababad:
PRINTED AT THE PIONEER PRESS.

1000

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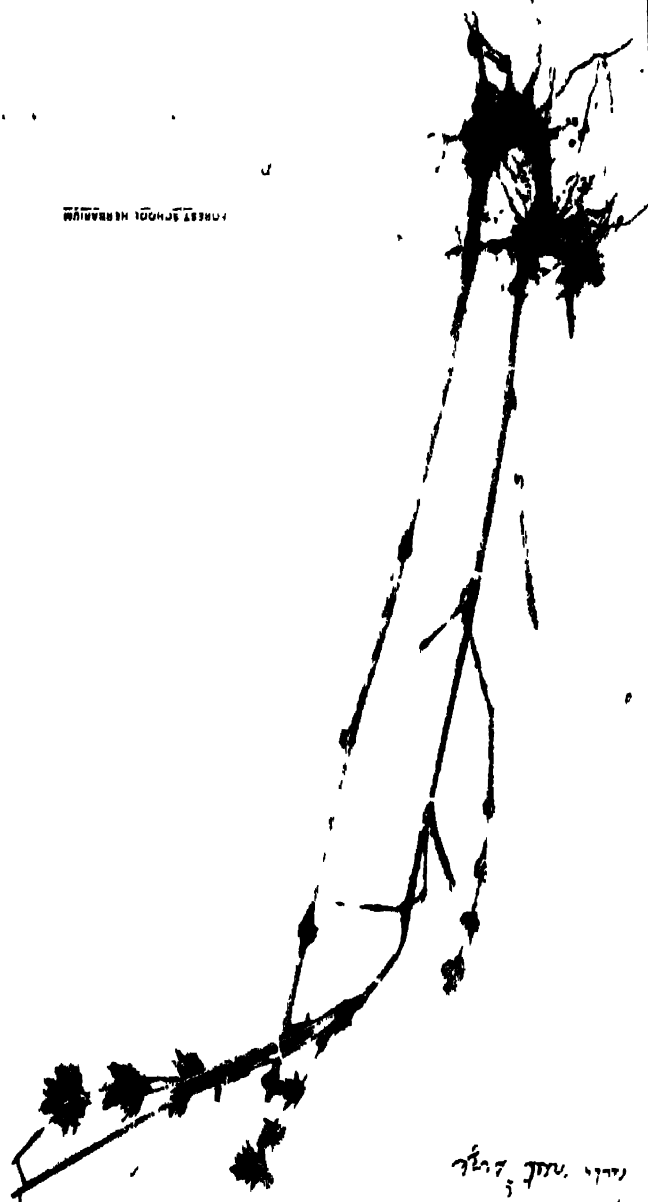
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Willowberry

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DWARA DUN,
30th January, 1899.

THE INDIAN FORESTER.

Vol XXV.]

January, 1899.

[No. 1.

Biological Notes on Indian Bamboos.

BY SIR DIETRICH BRANDIS, F. R. S.

Indian Foresters, who have had the good fortune of witnessing the flowering and seeding of some of the gregariously and periodically-flowering Bamboos, will probably agree with me in thinking, that a series of remarkable phenomena on a grand scale takes place before our eyes, opening up a multitude of interesting questions, many of which still await solution.

BIOLOGICAL CLASSIFICATION OF BAMBOOS.

Before, however, proceeding further, it will be well to come to an understanding regarding the classification of Bamboos from a biological point of view. The classification, which I have in my mind at present, is two-fold, in regard to the growth of the rhizome, and in regard to the mode of flowering.

In regard to the rhizome we have two classes : those which form large, more or less dense, tufts or clumps, such as *Bambusa arundinacea* and *Dendrocalamus strictus* ; and those, the rhizome of which sends out long underground branches, which bear isolated stems or small tufts of stems. The Bamboos of the latter class exhibit great variety in their manner of growth. That remarkable species, which covers large areas in the Maytharouk forests of the Upper Salween district, and which is described in para. 368 of my Burma Inspection Report of 1881, only has separate stems, which are evenly distributed over the forest. Several species of *Phyllostachys*, on the other hand, form clumps or clusters, but the rhizome sends out long branches running underground, which, at some distance from the mother clump, bring forth single stems or tufts of a few stems each. Between these two extremes there are numerous intermediate forms.

Matters are analogous, when we attempt to classify Bamboos according to their habit of flowering. A number of species flower annually, the same clump has leaf-bearing and flowering stems, the latter terminate in a flower panicle and bear leaves in the lower portion. In South America these annually-flowering species are common, and they belong to *Arundinaria*, *Bambusa*, *Guadua*, and other American genera. In India the number of species known to flower annually is limited. The one best known is *Arundinaria Wightiana*, Nees, on the Nilgiris and on other hills near the Western Ghâts. There may be others besides, for a number of species have leaves on and below the flower panicle, which however does not necessarily prove that the species flowers every year. Other annually-flowering species are *Ochlandra stridula*, Thwaites, of Ceylon, and *Bambusa lineata*, Munro, a shrubby species of the Andamans and the islands of the Indian Archipelago. At the other end of the series stand those Bamboos which we generally designate as flowering periodically and gregariously, and of these *Bambusa arundinacea* and *polymorpha* may be mentioned as types. Between these two extremes there are numerous species which occupy an intermediate position in regard to their habit of flowering. Of these, some at times are found in flower over large areas, and after a series of years they are found to flower again in the same locality. The same species, however, is also found to flower sporadically, and in such cases leaf-bearing stems are not rarely found in a flowering clump, and at times some of the flowering stems bear leaves. Of these intermediate species, which we may term irregularly-flowering, the one best known is *Dendrocalamus strictus*.

Those who have witnessed the periodical flowering of species of *Strobilanthes* on the Nilgiris, and the gregarious flowering of Bamboos, doubtless have been struck by the coincidence of gregarious habit and periodical flowering. *Strobilanthes Kunthianus* flowers in periods of 5 to 6 years, *S. sessilis* flowers every fourth or fifth year, *S. gossypinus* every tenth year. All these three species are eminently gregarious, covering almost exclusively large areas on the slopes. *Bambusa arundinacea*, *polymorpha*, and *Dendrocalamus strictus*, are all eminently gregarious. It does not however follow, that all gregarious Bamboos or *Strobilanthes* flower periodically, or that the annually-flowering species should occur only sporadically. Two annually-flowering *Strobilanthes*, *asper* and *luridus*, form the underwood in sholas over large areas or at least did so formerly. *Arundinaria Wightiana* is gregarious, and of *Ochlandra stridula*, Trimen reports that it covers hundreds of square miles of country in the South and West of Ceylon.

So far regarding the classification of Bamboos with reference to their mode of growth and their manner of flowering. The

systematic classification has been placed upon a solid footing by the description and figures in Mr. Gamble's admirable Monograph.* To talk of the habits of Bamboos and of the management of Bamboo plants, has little meaning and is of no practical use. Each species has its own peculiarities and its own requirements, and as the number of known Indian species is about 120, it follows, as a matter of course, that without a reliable guide, the study of Bamboos in India would be hopeless. Mr. Gamble's work will enable Indian Foresters to determine more fully the peculiarities and requirements of all important kinds.

BAMBUSA POLYMORPHA.

On my first journey across the Pegu-Yoma range, from Toungoo to Prome, in April 1856, in the Khaboung and Nawing Forests, I greatly enjoyed the shade of Kyathaunwa, *Bambusa polymorpha*, which was in full leaf, forming a high dense underwood under the tall trees of *Nydia dolabriformis*, *Terminalia tomentosa*, Teak and other kinds. Again, in 1857 and 1858, I spent the greater part of the dry season in the Kyathaunwa forests on the Pegu-Yoma of the Tharawaddi and Prome districts.

In the hot season of 1859, the same species came into flower in this part of the country; and in March 1861, the hills a little further North, at the headwaters of the Choungoungyee and Swah rivers, were quite impassable, because the dry stems of Kyathaunwa had fallen, forming a tangled mass, which had blocked up every pathway. The same thing had happened in the southernmost portion of the Pegu-Yoma, for I find in my diary of 20th December 1860 the following entry regarding the Magayee forests on the hills near the Upper Kayoo Choung "Kyathaunwa has flowered in 1859, its dry stems make the forest almost impassable," and it is well known that Kyathaunwa in 1859 flowered all along the west side of the Pegu-Yoma in the Tharawaddi and Prome districts. In that year I was not in the Pegu Forests, but (December 1858 to June 1859) was at work in the forests of Martaban and Tenasserim. I have, however, in my herbarium, flowering specimens collected in 1859.

In 1861, I crossed the Yoma range on my march from the Irawaddi to the Sitang river. I had heard that Major Phayre, the Commissioner of Pegu, was coming on the same line in an opposite direction. As I wished to meet him at a particular spot on the Yoma range, I left servants, baggage and horses behind, and for many hours scrambled in the burning sun over the masses of fallen Bamboos, until I met a

*The Bambusaceae of British India, Vol. VII of Annals of the Royal Botanic Garden, Calcutta, 1896.

party of Karens, who were clearing the way over the hills for the Commissioner's camp, when progress became easy and rapid. This was on the 2nd March 1861. We spent a delightful evening together, settling many things relating to the management of these Teak forests. We had no idea then, that a despatch from the Government of India was on its way from Calcutta to Rangoon, ordering the Teak Forests of Pegu to be thrown open to private enterprize. This, however, as well as the measures which the Commissioner and myself took, when we had received and had discussed that despatch, in order to carry out the instructions contained therein, does not affect the growth of Bamboos, and need not, therefore, be related on the present occasion.

DEVELOPMENT OF BAMBOO CLUMPS.

The jungle fires of March, April and May subsequently swept away the tangled masses of dry stems, and after the rains of 1861, the ground everywhere was covered by millions of seedling Bamboos, which soon grew up into slender plants, 2 to 3 feet high, forming dense waving green masses on the ground under the trees.

The first process which takes place is, that among those millions of plants the strongest get the upper hand, and that they gradually grow into those remarkable clumps or bushes which consist of a huge underground rhizome composed of innumerable stout twisting branches, which rhizome carries a large number of leaf-bearing culms or stems. The development of a Bamboo clump from a slender seedling is a most remarkable process, which has not yet been studied sufficiently. It may interest Indian Foresters to read what I have been able to ascertain on this subject, and my hope is that the imperfect data, which I now place before them, may induce my younger friends to follow up this subject, and some day to publish a complete account of it in the pages of the *Indian Forester*.

BAMBUSA ARUNDINACEA.

On the Poratty saddle at the headwaters of the Noyil river in the Coimbatore district of the Madras Presidency, in March 1882, I came across large patches of young seedlings of *Bambusa arundinacea*. The species had evidently flowered in 1881, and the seed had germinated during the rains of that year but exhibited different stages of growth. The youngest of these plants consists of one shoot, about 6 inches long, bearing 2 or 3 leaves at the top, and below these a sheath of the usual length, furnished, not with a complete leaf, but with a small imperfect blade. Near the ground the

shoot bears a short membranous-pointed sheath, at the base of which there are two rootlets, about 3 inches long. At a later stage, just below the surface of the ground, several conical side shoots make their appearance, which are bent, first downwards, then upwards, and which are covered with numerous white membranous sheaths. These side shoots afterwards ramify, and they are the beginning of the rhizome. At the bend they send rootlets down into the ground, while at the top they produce a leaf-bearing stem. Besides these side shoots with short internodes, which are therefore completely covered by the overlapping membranous sheaths, there are underground shoots with moderately long internodes, which root at the nodes and which, from these points, also send up leaf-bearing stems.

In this manner it happens that seedlings, not quite a year old, have an underground rhizome of complicated build, sending numerous rootlets into the ground, and bearing a number of stems. I have such specimens before me, with six stems, some of which are 12 inches long and are furnished with 6 to 8 leaves. The stems first formed are short-lived, and in some of the more advanced seedlings, they are dead and dry.

OTHER SPECIES.

In all essential points the mode of development is the same in those species which I have been able to examine. To the kind attention of Mr. Oliver and Mr. Gamble, I owe a valuable collection of seedlings of different species in two stages, 12 and 24 months' old.

Bambusa Tulda, Roxb. 12 months old: First shoot dead, the second branched, two lateral shoots at the ends of short rhizome branches, which are covered with membranous sheaths. Shoots 8 inches long, with 5 to 7 leaves. Rootlets numerous, 6 inches long.

The same, 24 months old: Rhizome 2 inches in diameter, consisting of 6 stout short branches, which are bent in the middle and are entirely covered with broad, short, pointed, glabrous, shining and ribbed membranous sheaths. Four of these rhizome branches bear at their ends leaf-bearing shoots, which are all branched, the longest being 18 inches long. Primary shoots in the centre, all dead. Rootlets numerous.

Bambusa Oliveriana, Gamble. 12 months old: A well-formed rhizome, the branches bent in the usual way; 2 or 3 primary shoots dead, 3 or 4 lateral shoots, all branching from the base, the branches not easily distinguished from the main shoots, thin, 12 inches long.

The same, 24 months old. The portions of a rhizome separate readily from each other; branches long, hooked, entirely covered with short, broad, membranous sheaths. Shoots much branched, 16 inches long.

Bambusa longispiculata, Gamble, nova species. 12 and 24 months old. Development of rhizome and of shoots similar to *B. Tulda*.

Dendrocalamus strictus, Nees. Branches of rhizome very long (2 inches) creeping horizontally, at the ends bent upwards, sending up shoots, some of which are undeveloped. Rhizome sheaths broad, ribbed, hairy and ciliate at the edges. First primary shoot dead, second branched; one side shoot only at the end of a rhizome-branch developed. Longest shoot, 15 inches long with 7 leaves.

The same, 24 months old. Rhizome branches very stout at the bend, $\frac{3}{4}$ inch diameter. All shoots branched, youngest $\frac{1}{2}$ inch diameter at base. Shoots 30 inches long.

Dendrocalamus membranaceus, Munro. Development of seedlings similar to that of *D. strictus*, but rhizome branches not so long. Rhizome sheaths hairy and ciliate at the edges.

Dendrocalamus Brandisii, Kurz, 12 months old. Rhizome branches short, bent at their ends. Unbranched shoots, the longest 18 inches long, bearing eight leaves. Rootlets very numerous, 9 inches long, much branched.

Cephalostachyum pergracile, Munro, 12 months old: Branches of rhizome much bent, each bearing a shoot, the largest of which is 12 inches long with five to six leaves. Primary shoots dead.

The same, 24 months old. Rhizome much developed, branches long, growing more downwards than sideways. Shoots much branched, the largest $\frac{1}{2}$ inch diameter, 25 inches long.

THE RHIZOME OF SINGLE-STEMMED SPECIES.

The species just described are all tufted or caespitose. *Dendrocalamus membranaceus*, according to Gamble, forms loose clumps, in the others the clumps are dense, bearing numerous stems closely packed. Of single-stemmed species I have no early stages, but I owe to Mr. Gamble a specimen of *Arundinaria jaunsarensis*, apparently just full grown, as some of the stems have their full size, $\frac{1}{2}$ inch in diameter. It consists of a rhizome bearing six stems, two of which have the full thickness of $\frac{1}{2}$ inch, while the others are smaller. This rhizome sends out in different directions, three long, more or less, horizontal branches, with internodes about half an inch long. Two of these are broken off, the third is 30 inches long, straw-coloured, shining, slightly ribbed and marked by the oblique raised lines, where the sheaths were attached. The sheaths are mostly fallen, they are glabrous, shining, triangular and acuminate, about $1\frac{1}{2}$ inches long. The diameter of this underground branch is uniformly $\frac{1}{2}$ inch.

At the end it bears a second rhizome, with two culms of nearly the full thickness; and from this second smaller rhizome, proceed in different directions, two other underground rhizome branches, similar to the one just described. These two rhizome branches are broken off.

It may perhaps for the present be assumed, that those Bamboos, which have both culms in tufts and single stems, grow in the manner here described for *Arundinaria jaunsarensis*. To these belong several species of *Phyllostachys* from China and Japan, particularly *Phyllostachys bambusoides*, Sieb. et Zucc. the tufts of which send out numerous creeping underground branches. These bear single culms, or small tufts of a few culms each, which come up in paths or in the midst of a flower bed. This habit of *Phyllostachys* gives gardeners in Europe much trouble, where they are cultivated.

Whether the other single-stemmed Bamboos grow in the same manner, I am unable to say. I would specially recommend to the attention of Forest officers, who may be disposed to enquire into this matter, the single-stemmed Bamboo previously noticed, which is called Tabendein Wa by Burmans, and Wabgai by Karens. It was found by me in the Upper Salween and the Yoonzaleen forests and is mentioned in paras. 368 and 372 of my Suggestions regarding Forest Administration in Burma of 1881. This species never forms tufts, but all stems come singly out of the ground at even distances from each other. An accurate description of the development of the creeping rhizome of this species from the seedling would be most interesting. Formerly, I regarded this Bamboo as *Bambusa villosula*, Kurz, but Mr Gamble, who has kindly examined my specimens, refers them to *Gigantochloa macrostachya*, Kurz, which however is described as caespitose.

SINGLE-STEMMED BAMBOO OF THE WESTERN GHATS.

Other single-stemmed species are *Arundinaria racemosa*, Munro; *A. Polloana*, Gumble; *Bambusa nutans*, Wall; *Melocanna bambusoides*, Trinius; *Pseudostachyum polymorphum*, Munro.

A single-stemmed *Oxytenanthera* I would specially recommend to the attention of Forest Officers in Coorg, Mysore and the Southern portion of the Bombay Presidency. Regarding this species, which probably is *Oxytenanthera monostigma*, Bedd. my diaries and rough notes have the following entries.

23rd April 1868, south of Anantapur (Shimoga district of Mysore): "Hills covered with dry forest, with the small bamboo found first in south Coorg and afterwards in the Luckovalli forest in Mysore. It is called Seeb hen, Galti, in Luckovalli. Its

'characters are the isolated stems, almost solid when mature, long sheaths with long narrow blades, small leaves and long-pointed, almost spinescent spicules.'

2nd April 1870, in the North Kanara Teak Forests : "Four species of Bamboo, (1) *Bambusa arundinacea* (2) A climbing Bamboo (3) *Dendrocalamus strictus*, (4) Chiwa, Mar.; Chua, Chawa, Kan. Stems isolated, when young clothed with whitish velvet, grey when old. Internodes 15 to 18 inches long. Culm sheaths as long as internodes.'

5th May 1870. Between Mulla and Helwauk on the Sattarah ghâts. "Bamboo is found all over the jungle of these villages, but so stunted and hacked, that I did not see one well-grown clump. The people call it Chiwa, the stems are generally solid and when young covered with whitish down, just like the Chiwa of Kanara. They say that the culms grow about 9 feet high."

Of this species I have specimens in flower collected in April 1870 in the North Kanara Teak Forests, and Gamble (page 74) mentions specimens collected by me in Coorg and North Kanara. These specimens probably are at the Calcutta herbarium. The chief reason why I am not quite certain about the species is that Mr. Talbot in his most useful systematic list of trees and shrubs of the Bombay Presidency does not mention that *Oxytenanthera monostigma* has the stems isolated and not in tufts or clumps as most other Bamboos. The climbing (rather semi-scandent) Bamboo mentioned above is doubtless *Teinostachyum Wightii* Bedd.

DEVELOPMENT OF LEAF-BEARING STEMS.

We now return to the development of the caespitose species. Every year the rhizome sends up a number of fresh shoots; and, as the rhizome increases in size, the shoots are stouter and larger every year, until they have attained their full size. At that time, we may say, the clump has attained maturity. The number of years required, until this point is reached, doubtless is different for the different species, but it probably also varies with soil and climate.

Very little certain information is available regarding the time required for the seedling Bamboo to attain maturity. Of *Bambusa arundinacea* at Dehra Dûn, A. F. Broun reports that clumps five years old had produced shoots 6 to 10 ft. long. In the Pandratola reserve on the South face of the Satpura range in the Central Provinces, the same species had flowered in 1869. When I visited this forest in February 1876, the thickets of young plants which had come up in place of the old clumps were 15 ft. high. As a rule, this species is 70 to 90 ft. high when the rhizome has attained maturity. From Travancore

Mr. Bourdillon reports that *Bambusa arundinacea* was full-grown 12 years after seeding (I. F. XIII, p. 579). In a later communication (I. F. XX, p. 469) he states that 8 or 10 years must elapse before full-sized culms of this species can be obtained. Mr. Jasper Nicholls says his experience is, that no clumps can be said to come fairly into bearing full-sized stems in less than 15 years, (I. F. XXI, p. 95). *Bambusa polymorpha*, which had flowered in the Pegu-Yomah hills in 1859, had, when I visited those hills in 1868, grown up into a forest similar to that which I had known before flowering; the tufts, however, were small, that is, they had not yet as many stems as formerly. I have said the rhizome has attained maturity when it produces culms of the usual full size. By the formation of new underground branches, however, the rhizome continues to expand up to a certain size, and consequently bears a larger number of stems when older.

It is not, however, the age of the rhizome alone which influences the size of the stems produced by it: the vigour of the rhizome is influenced by other conditions also. Before fire protection was commenced in the Bori Forest of the Central Provinces, the stems of *Dendrocalamus strictus* produced under the régime of the annual fires, were short and small. After fires had been excluded during a number of years, and the soil had become soft and enriched by the decay of the leaves, the stems produced by the same clumps increased in length and thickness. The same species in Pegu, on dry hills, only has culms 30 feet long, while clumps on the rich, deep soil of a dell produce stems 40 to 50 feet long. Mr. Jasper Nicholls, speaking (I. F. XXI, p. 91) of the extraordinary length of Katang Bamboo poles sent from the Balaghat district to the Nagpur Exhibition, Christmas 1865, accounts for their unusual length in this way: "These bamboo clumps grew 'on deep soil, in a moist valley, very close to one another.'"

On the other hand it is well known, that clumps which are weakened by overcutting, gradually produce shorter and thinner stems.

And when all stems are cut, the rhizome only produces thin, whip-like branches. This fact may be said to constitute one of the great points of difference between a Bamboo Forest and a coppice wood. In an Oak coppice, all shoots are cut when they have attained the requisite age, and the rootstock, if strong enough and healthy, next year will produce a crop of shoots of the same size. The coppice shoots of Dicotyledonous trees, however, have this point in common with Bamboos that the rootstock, say of a Teak seedling, which has been cut down by the jungle fires, in the first year produces small and weak shoots, but through the action of the leaves, gradually gets strength enough to send forth stout tall shoots, which resist the action of the fires,

THE FLOWERING OF BAMBOOS.

We now approach the important question, whether the gregariously-flowering Bamboos always and necessarily come into flower, when the rhizome has attained a certain age. Before, however, attacking the general question, it will be well to mention, that there is no absolute regularity in this matter. A species may come into flower simultaneously in a certain tract of country, while in an adjoining tract the flowering takes place a few years later. And there is no doubt, that frequently individual clumps come into flower, either after a general flowering has taken place, or in advance of it. Thus I see it noticed in Mr. Gamble's excellent work on the Bamboos of British India, page 37, that *Bambusa polymorpha* was collected in flower by me in 1862 in the Zamayi forests, and afterwards by Sulpiz Kurz in the Thaukyeghat district in 1871. The specimens of these two gatherings are, I presume, at the Calcutta Herbarium. In the Zamayi (Upper Pegu) forests, I was at work from 18th January to 7th February 1862, but the Forest diary which I have now before me, does not mention the flowering of Kyathounwa, nor does it mention that the ground was covered with seedlings of that species. My opinion is, that in the Zamayi forests, which occupy the high hills at the head-waters of the Pegu river, Kyathaunwa did not flower in 1859, though the same species in that year came into flower all over the west side of the Yoma range at the head-waters of the streams which run into the Irrawaddi and Ulaing rivers. I am disposed to think, that the specimens gathered in 1862 and 1871, must have come from clumps which had flowered out of their time.

It may not, I fear, be possible to put together at the present time, a complete history of the flowering of *Bambusa polymorpha* in Pegu in 1859 and subsequent years. This shows how necessary it is, that the flowering and seeding of all periodically-flowering Bamboos should be fully recorded at the time this event takes place. An excellent plan would be, if some Forest Officer in Burma would take the trouble once a year to send to the "Indian Forester" a statement of the species which have flowered during the year in that province as well as of the area over which the flowering of each species had extended.

BAMBUSA ARUNDINACEA.

That species, regarding the periodical flowering of which the most complete data have been collected, is the spinescent thick-walled Bamboo, which is common in both the Western and Eastern Peninsula, and which is cultivated largely in Northern India, *Bambusa arundinacea*. In his Forester's Manual

for Southern India, page 229, Colonel Beddome records that on the West side of the Peninsula, viz. in Malabar, South Kanara, the Wynaad and Coorg, this species had flowered three or four years before 1869, say in 1866, that a similar event took place about 30 years previously, say in 1836, and that from records he saw, it had occurred also in 1804. The conclusion seemed natural, that this species comes into flower when it has attained the age of about 30 years. Two successive flowerings are also recorded for this species (planted) at Dehra Dún, 1836 and 1881, with an interval of 45 years.

General flowerings of this species are on record for many districts from 1804 to 1896. In the following list I have entered those which appeared to me to be authentic, and wherever it seemed necessary, I have indicated where such flowering is recorded.

- 1804 Western Coast districts, Beddome.
- 1812 Orissa, S. Kurz, I. F. I, 259.
- 1817 South Travancore, Bourdillon, I. F. XX, 469.
- 1836 Dehra Dún, (planted) and Western Coast districts.
- 1839 On the Nerbudda river, between Jubbulpore and Mundla, Munro Trans. Linn. Soc. XXVI, 3.
- 1864 North Kanara, S. Kurz, I. F. I, 259.
- 1865 Balaghat district, Central Provinces.
- 1868 Western Coast districts, Beddome.
- 1869 Pandratola Reserve, South face of the Satpura range. Central Provinces, D. Brandis.
- 1870 Jubbulpore (planted) "four-fifths of the Bamboos in Sleeman's park and throughout the station burst into flower, seeded and died." Jasper Nicholls in I. F. XXI, 91.
- 1870 Portion of South Travancore, Bourdillon, I. F. XX 469.
- 1879-80 North Travancore, Bourdillon. I. F. XX, 469.
- 1880 Oudh, Capt. Wood. I. F. VII, 59.
- 1881 Dehra Dún (planted) I. F. VI, 336.
- " Basudeo, Kumaon I. F. XII, 413.
- " Poratty saddle, head-waters of Noyil, Coimbatore district, D. Brandis.
- 1882 Travancore, Bourdillon, I. F. XIII, 409.
- " Narsinghpur, two clumps in the Deputy Commissioner's compound, Jasper Nicholls I. F. XXI, 91.
- 1885 Rajim on the Mahanadi river, Central Provinces, Jasper Nicholls, I. F. XXI, 92.
- 1889 Nallamalai Hills, Kurnool, Gamble, Bamboos, p. 54.
- 1894 Cuddapah, Gamble, Bamboos, p. 54.
- 1896 Rajpipla State, I. F. XXII, 222.

The question evidently demands more study in detail. Each district must be taken up separately, and the successive flowerings in that district must be determined. We ought to bear in mind what Mr. Bourdillon states regarding the seeding of this

species in Travancore in 1882 (Indian Forester XIII, p. 579.), "The seeding was not general all over the country. South of 'a certain line the seeding took place about a dozen years ago, 'and the bamboos thus are now full grown. Isolated clumps 'in the cultivated parts also failed to seed."

The simultaneous flowering and seeding of this species, as well as of *Bambusa polymorpha*, may at times extend over a considerable area, yet it always is local. Occasionally the flowering in remote districts may coincide, as was the case in 1886 at Dehra Dún and on the Western Coast, in 1870 at Jubbulpore and South Travancore, but this is accidental. Nor has a regularly periodical flowering yet been proved for any particular district.

OTHER PERIODICALLY-FLOWERING SPECIES.

Regarding *Bambusa Tulda*, the species most commonly cultivated around the villages of Lower Bengal, which is indigenous in Assam and is well known in Burma as Thaikwa, Gamble says that it undoubtedly has the habit of flowering gregariously over considerable areas. The flowering of this species has been reported for the following years.

1866	Mulda district, Lower Bengal.*	
1867 and 1868	Lower Bengal, Kurz.	
1872	" "	C. B. Clarke.
1884	" "	" "
1876	Chittagong,	Lister.
1886	" "	Ellis.
1863 to 1868	several times, Burma,	D. Brandis.
1880	" "	" "
1889	Assam	Gustav Mann.

Isolated clumps of this species, however, not rarely come into flower, and it may be doubted whether *Bambusa Tulda* should be classed among the strictly periodically and gregariously-flowering species.

I will here mention the Bamboo described by Nathaniel Wallich, the Superintendent of the Calcutta Gardens, in a Report to Government of 1825, extracts from which are given on page 376 of the "Indian Forester," Vol. VII. This celebrated Bamboo grove surrounded the city of Rampore in Rohilkhand to a breadth of 30 to 40 ft. The whole flowered in 1824, not a single stem being seen which was not dead, they were all leaning on each other or had fallen to the ground thickly covered by myriads of seedling Bamboos growing under the protection of the dead

*Munro Trans. Linn. Soc. XXVI, p. 4, says that the seeds were eaten during that year of scarcity. It most probably was *B. Tulda*. See also Kurz (Indian Forester I, p. 259).

stems. Dr. Wallich was told that 40 years ago the grove had been reproduced in the same manner, and that similar renewals had succeeded each other for ages past. Wallich found this Bamboo to be of the common *unarmed* kind. There is no indication of the species in the extract, it may have been *Bambusa Tulda*, *Balcooa* or *nutans*.

A large Bamboo, which is believed to flower at long intervals, is *Bambusa nutans*, Wall., indigenous in Eastern Bengal and Assam, and cultivated near villages in Dehra Dún. This is one of those species, the stems of which do not grow in dense clumps, but arise singly from a creeping rhizome. In the Dún it flowered in 1840, and has for some years past been expected to flower again.

Another single-stemmed Bamboo is *Melocanna bambusoides*, Trinius, of Eastern Bengal and Burma. Munro reports that it flowered and seeded in 1863 to 1866 all over the Chittagong hills, so much so, that it caused a great scarcity of building materials. In Assam it came into flower in 1892. Kurz (Indian Forester I, 257) and Gamble (Bamboos, 120), are of opinion that its period is about 30 years.

Regarding some of the large Bamboos of the Indian Archipelago, Kurz (Indian Forester I, 257) thinks that the clump, that is the rhizome, attains the age of 100 years.

A number of the smaller Bamboos (*Arundinaria*, *Phyllostachys*) appear also to flower periodically and gregariously.

Arundinaria spathiflora, Trinius, the Ringal of the North-west Himalaya, which grows as a thick underwood at elevations from 7,000 to 10,000 feet, in Forests of *Quercus semecarpifolia*, *Pinus* and *Abies*, was found in flower by Wallich, in 1821, in Nepal; has flowered in Jaunsar in 1881 (D. Brandis), and 1882 (W. R. Fisher); and was again found in flower by Gamble in 1892 at Deoban and in 1893 on Kedarkanta.

Arundinaria intermedia, Munro, in the Eastern Himalaya, growing gregariously between 4,000 and 7,000 ft. was first found in flower by Hooker in 1848, by T. Anderson in 1868, and by Gamble in 1879. The two species would seem to have a period of 9 to 10 years, but Gamble justly draws attention to the fact that isolated flowering clumps are occasionally met with.

Regarding the gregarious flowering of some Japanese and Chinese species of *Arundinaria* and *Phyllostachys*, interesting data have been published in a work by A. and C. Rivière * *Arundinaria japonica*, which had been introduced from Japan about 20 years previously, flowered in 1867 and 1868, nearly simultaneously in the Bois de Boulogne, at Sceaux, at Marseilles and in the large experimental Garden of Hamma in Algiers.

* Les Bambous, par Auguste Rivière et Charles Rivière, Paris 1867,

Arundinaria falcata flowered about 35 years after having been introduced in 1875, at Angers, Nantes, Hamma, and a little later (in March and April 1876) at Paris.

Phyllostachys flexuosa had been brought from China in 1864 and flowered at Hamma in February 1876, at Toulon in May, and at Paris in July of the same year. It will be noticed that the two last species came into flower at a later date in a colder climate.

THE PERIODICALLY-FLOWERING STROBILANTHES COMPARED WITH BAMBOOS.

There is some analogy between the gregarious and periodically-flowering Bamboos and those species of *Strobilanthes*, which are gregarious and flower at certain intervals, after periods of from 5 to 12 years. In both instances there is an underground rootstock or rhizome, which annually sends up leaf-bearing stems. When the rootstock has attained a certain stage, and when sufficient stores of starch and other substances have been accumulated in it to furnish the needful materials for the development of flowers and seeds, then flower-buds instead of leaf-buds are formed on the branches, the stems are covered with flowers and seeds and after the seeds have ripened, the whole plant dies.

As far as our present knowledge goes, the period of flowering in the case of species of *Strobilanthes* are fixed for each species, while in the case of the gregarious and periodically-flowering Bamboos, there appears to be a considerable latitude. With regard to Bamboos, the great irregularity in the periods of flowering makes it impossible to entertain the assumption that, when the rhizome of a Bamboo clump has attained a certain age, it must necessarily produce flowers and seed in the place of leaves. A more likely assumption seems to be that the condition of the rhizome, that is, the accumulation in it of a sufficient quantity of starch and other substances, is one of the conditions that must be fulfilled before flower-buds can be formed in the place of leaf-buds. Other conditions, however, must co-operate before the formation of flower-buds can actually take place. These conditions may depend upon soil, upon climate, or upon other matters.

THE FLOWERING GOVERNED BY OTHER CIRCUMSTANCES BESIDES AGE.

In this respect some remarks made by the late Sulpiz Kurz in an excellent paper on Bamboos (Indian Forester I, 259) merit special attention. During the two dry seasons of 1868 and 1869, which he spent in Burma in order to collect data for his Forest Flora, he was so fortunate as to collect an

unexpectedly large number of Bamboos in flower. This he ascribes to the unusual heat and drought of those seasons. Again, he says that in the Calcutta Botanic Garden there never had been so many species in flower as in 1874, which was a year of great drought and scarcity in Lower Bengal.

It has above been stated, that *Bambusa arundinacea* flowered in 1864 in North Kanara, and in 1865 in the Balaghat district of the Central Provinces, and that a general flowering of *Bambusa Tulda* in the lower Provinces of Bengal took place in 1866. And certainly in Bengal, and in a large portion of the peninsula was the Monsoon of 1864 and 1865 quite insufficient, and consequently there was great drought and heat. But it can in no way be maintained that the years of Bamboo-flowering have always followed years of drought and scarcity.

Nevertheless, it is quite possible that when the rhizome has attained that stage when flowering would be possible, an unusually dry and hot season may have the effect of accelerating the formation of flower-buds in the place of leaf-buds. It should be remembered, that such stimulating conditions must act upon the plant, at least a year before the flowering actually takes place.

EUROPEAN FOREST TREES FLOWER AND SEED AT IRREGULAR INTERVALS.

Those readers of the "Forester," who have had the privilege of seeing some of the forests of Europe, will remember that the European Forest trees, the Beech, the Oak, the Spruce and the Silver Fir, do not flower and seed regularly every year, but at intervals which vary in each species with soil, elevation, climate and other conditions. They may also remember the admirable researches made by Robert Hartig at Munich in 1888 on the part which the accumulations of starch in the medullary rays and wood parenchyma of the Beech tree play in regard to the seed years of that species.

Formerly it was supposed that the stores of starch and other reserve substances, which are deposited in the wood of Beech trees, were consumed by the development in spring of the leaves. Robert Hartig, however, has proved that the starch in the wood gradually accumulates, until a mark year arises, when it is entirely consumed by the development of the flower and the formation of the seed.

It is probable that a similar process takes place in the case of all trees which flower and seed at intervals of several years; and it is not impossible, that before periodically-flowering Bamboos are in a position to form flower-buds in the place of leaf-buds, the rhizome must have attained a certain condition, that is, it must contain sufficient accumulations of starch and other reserve substances.

IRREGULARLY-FLOWERING SPECIES.

So far regarding those species, which always flower simultaneously over large tracts of country, all stems of each clump producing nothing but flowers and seed. There are many other species, which are more irregular in their habits. Sometimes all clumps on a limited tract of country come into flower at the same time, at other times isolated clumps or groups of clumps produce flowers and seed, and frequently some stems of the flowering clumps bear leaves.

Of this class, the best known example is *Dendrocalamus strictus*, that species, which is one of the few Bamboos, with a wide range of distribution, being indigenous not only in the Western and Eastern Peninsula, but also in Java and other islands of the Indian Archipelago.

In Burma, where it is known as Myinwa, and where it generally is the prevailing species, in dry localities, this kind often flowers gregariously over extensive areas, while on the outer hills and in the outer valleys of the North-west Himalaya, isolated clumps or groups of clumps are more commonly found in flower. Mr. Gamble (p. 79) mentions the following instances of the gregarious flowering of this species in the Western Peninsula :—

1865	in the	Central Provinces.
1870	„	Garhwal.*
1880	„	Oudh.
1887	„	Kurnool.
1890	„	Golgonda Hills, Vizagapatam.
1891	„	North Arcot.

A curious instance of the successive flowering of this species in a series of contiguous localities is mentioned by A. F. Broun (I. F. XII, 414.). In 1888 the seeding began in the South-east corner of the Dún, then in 1884 turned the corner of the Siwaliks at Hardwar and continued in a North-westerly direction in 1885 and 1886, when, according to a communication since received from Mr. Gamble, it stopped in the Rauli Block.

One or two other species of this genus belong to the same class with regard to their flowering and seeding. *Dendrocalamus Hamiltonii*, Nees et Arn. a remarkable species of Nipal, Sikkim, Assam, and the Upper Irrawaddi near Bhamo and Katha, easily known by its thick over-hanging stems and purple flowers in a huge panicle, generally flowers sporadically, but at times gregariously, as reported by Gamble (p. 86)

*In the 'Indian Forester' II 89, R. C. W. reports a general seeding of Bamboo in 1872, on which the chief Forest Revenue of his district depended. Species or name of district are not given, but the province probably was Bombay and the species *Dendrocalamus strictus*.

in Sikkim and Dehra Dún (where it is extensively planted near villages) in 1894.

Dendrocalamus longispathus, Kurz, of Silhet, Chittagong and Burma, easily recognized by the large papery culm sheaths, densely clothed with black stinging hairs, whence the Burman name Wa-ya, probably belongs to the same class.

Cephalostachyum pergracile, Munro, the Tin-wa of Burma, which extends North as far as the Naga Hills in Assam, and is probably also indigenous in Chota Nagpur, I have often found in flower both gregariously and sporadically in Burma. Here it is very common, but does not form as extensive forests as *Bambusa polymorpha* and *Dendrocalamus strictus*. In my paper on the Ringals of the North-Western Himalaya (I. F. XII, 208), I classed this species with *Bambusa arundinacea* and *polymorpha*. This, however, was a mistake. I have found it in flower in 1859, 1861, 1862 and 1880.

Arundinaria falcata, the low level Ringal of the North-Western Himalaya, certainly belongs to this class. Like *Dendrocalamus strictus*, this species at times is found flowering sporadically, while at other times it flowers gregariously over large areas. Thus (Indian Forester XII, 414) A. F. Broun states that in 1886 this species was in flower all over the hills of Jaunsar and Tehri Garhwal and that wherever he found it, almost every culm was loaded with flowers. Gamble (p. 18) says "It has 'been frequently found in flower, and though, as happened in '1879, years of general seeding are of occasional occurrence, 'a few clumps may be found in flower in almost any year."

Of *Ochlandra travancorica*, Benth., a gregarious species of the higher Ghâts of Travancore and Tinnevely, Bourdillon reports (I. F. XIII, 579) that it seeded in 1875, and again over the same area in 1882, so that its period of flowering seems to be seven years. This Bamboo, however, also flowers sporadically. In February 1882, I found culms with leaves and flowers on the Tinnevely Ghâts. Hence I am disposed to place it among the irregularly-flowering species. As already mentioned, another species, *O. stridula*, which is gregarious in Ceylon, according to Dr. Trimen, flowers annually.

Several species of *Arundinaria* probably have the same habit of flowering, at times sporadically and at others times gregariously and periodically.

Of several species which at times flower gregariously and at other times sporadically, particularly of *Dendrocalamus strictus* and *Hamiltonii*, and of *Cephalostachyum pergracile*, Gamble records (p. 109, and Introduction p. 8,) that the seed produced at the general flowering is usually good, while that given in the sporadic flowering is often poor and of small quantity. This is a very remarkable and important point. Indian Foresters, who have opportunities for studying this

matter, would do well to make methodical experiments. The weight and the percentage of germinating seed of each species, the produce of general and sporadic seedings, should be determined, and I would suggest that this research be extended to species which, like *Bambusa arundinacea*, as a rule flower periodically simultaneously over large areas, but of which, now and then, single clumps are found in flower.

It now remains to mention a few other remarkable facts relating to the life-history of the species which have been discussed.

DO OFF-SETS ALWAYS FLOWER SIMULTANEOUSLY WITH THE PARENT CLUMP?

When cuttings are taken from an old clump of *Bambusa arundinacea*, or of other species of similar habits and planted out, it is well known that such cuttings in regard to the production of leaf-bearing shoots, behave in the same way as seedlings. During a series of years they only produce thin whip-like shoots, and only after a series of years has elapsed, a full-sized culm is thrown up, which, as in the case of seedling plants, shoots up to its full length generally in a few weeks, has dry, leathery sheaths at the nodes, and only a few green leaves at the top, the branches not appearing until several months later. Mr. S. E. Peal, in his interesting letter to the "Indian Forester" (VIII, 50) describes the development of the Jati Bans in Assam (*Bambusa Tulda*) from off-sets. In the second year, he says, the first whips may be 16 ft. high and an inch thick, nearly solid; the shoots of the third season may run up 30 ft. and be $1\frac{1}{2}$ or two inches thick in the stem, while the shoots of the fourth year are often full size.

An important statement, which Mr. Peal makes may here be incidentally mentioned, viz., that when off-sets are taken, it is only the young, one or two year old full-grown stems, that throw up fresh stems from the rhizome, older ones being nearly useless for propagation by off-sets.

As will presently be explained, the large *Dendrocalamus* in Burma takes a much longer time than *Bambusa Tulda* to produce full-sized culms from an off-set. In this point the off-sets of all species behave alike, that, like seedling plants, they only throw up whip-like shoots during the first years of their separate existence, that is, until the rhizome has acquired sufficient strength to produce full-sized stems.

In the matter of flowering, however, off-sets behave altogether differently from seedlings. Wherever a general flowering of *Bambusa arundinacea*, for instance, has taken place, all off-sets,

which had previously been taken from the parent clumps, invariably come into flower simultaneously with the parent clumps. Nor does this seem to be unreasonable, for that portion of the rhizome, which has been cut off and planted out, possesses the same ability and has the same disposition to produce flowers and seeds as the parent stock, though it has not the strength to produce full-sized stems.

A remarkable report, however, of a plantation of the large *Dendrocalamus* (Wabo) at Myanounng on the Irrawaddi river, published in "Indian Forester" II., 311, called *Dendrocalamus Brandinii*, but possibly *D. giganteus*, seems to imply that there may be exceptions to this rule. The writer, who signs himself A. O. F., describes a plantation of this species above 20 acres in extent, divided into blocks of half an acre to two acres, belonging to different villagers. The cultivators state that this bamboo flowers and dies at the age of 40 years, and in order to guard against the destruction by flowering of the bamboo resources of the whole area, they dig up a small portion of the stock, with a shoot of the year, and plant it in the beginning of the rains; and, though the rhizomes of both bamboos are of the same stock, the mother tree will flower and die long before the young plant. The writer adds that in the first year the off-set produces the small whip-like shoots, similar to those springing from bamboo seed, and that after seven years the culms produced by the rhizome attain a girth of 10 inches and a height of 40 ft. Shoots of this size are saleable, but it is not until the clump has reached an age of 15 to 16 years, that mature shoots are obtained.

It would be a matter of very great interest to ascertain, whether this remarkable exception really holds good in case of the Wabo. According to the writer's account, the plantation at that time was extremely profitable. He found 15 to 20 yielding clumps per acre, and states that when mature, all three years' old shoots are annually cut, each clump yielding three to four shoots, the amount paid to the cultivator being 20 annas for the largest, and 4 annas for the smallest. Assuming 12 annas as an average price, such a plantation in 1876 would have yielded an annual income of between 40 and 50 Rupees an acre.

The demand for large-sized Bamboos in Pegu has doubtless greatly increased and the price has probably not gone down. Most probably, therefore, such plantations still exist, where the state of things could be ascertained. Indeed, there seems no reason why the Forest Department should not, in the vicinity of one of the larger rivers establish such plantations of the gigantic species of *Dendrocalamus*. Such undertakings would pay and would furnish excellent opportunities for studying the life-history of the species,

FLOWERING OF MUTILATED CLUMPS.

Another remarkable fact, which is mentioned by Mr. Gamble on several occasions, is that when a clump of one of the periodically-flowering Bamboos is mutilated or injured, it produces flowers before its time. This he mentions in the case of *Bambusa Tulda* (p. 81) and *nutans* (p. 83). Lately I had the privilege of discussing the matter with him, and he has given me the following additional information. In 1892 a clump of *Bambusa Tulda* near Calcutta was blown down, the mass of rhizomes was torn out of the ground, and the culms were mostly out. In 1893 the rhizome brought forth numerous thin twigs with flowers; these, however, produced no perfect seed. The last year of flowering of *Bambusa Tulda* in lower Bengal has, as already stated, been 1884. Again of *Bambusa nutans*, a bush was found near Dehra Dun in 1893 on the edge of an embankment, with the rhizome exposed and the stems cut off. The rhizome had produced a number of flowering twigs, which, however, did not produce any perfect seed. The last general flowering of that species had, as already stated, been in 1840; in 1894, however, Mr. Gamble found another bush (not mutilated) in full flower.

This is another of the many interesting facts in the life-history of Bamboos, which demands further research. The practice of slashing the bark of apple trees in our orchards, in order to induce them to set fruit more freely, presents some analogy with the mutilation of Bamboo clumps.

I will here mention a fact which has often been discussed but has not, as far as I know, been established by accurate observation. When I witnessed the first general flowering of Bamboos in Pegu, my Burman friends stated that such an event could with certainty be foreseen, for during the year preceding the flowering, no new culms were formed. This fact, which is generally accepted in Burma, nevertheless requires confirmation by a series of systematic observations.

DOES THE RHIZOME ALWAYS DIE AFTER
FLOWERING?

It has already been mentioned, that, after the seed has ripened, the culms which had only produced seed and no leaves, perish. A different question is, whether in the case of the periodically-flowering species the entire clump, that is, the rhizome, perishes. In many cases this doubtless happens, particularly for those species which, as a rule, only flower gregariously and periodically, such as *Bambusa arundinacea* and *polymorpha*. The matter probably is different in the case of those kinds which, like *Dendrocalamus strictus*, often flower sporadically and in that case generally have either a few leaf-bearing culms, or a few leaves on the flowering culm. In such cases the rhizome probably often remains alive.

The question is discussed by Munro in the introduction to his Monograph (page 8), and he quotes Dr. T. Anderson, formerly Superintendent of the Botanic Gardens in Calcutta, in words to the following effect:—In 1857 and 1858 many of the Bamboos near Calcutta and on Parasnâth flowered and seeded, but in no case that Dr. A. was aware of, did a general death of the bamboo follow. So far as he observed, only the flowering shoots died; and their place was taken by young shoots springing from the roots; but during the flowering and seeding the foliage almost entirely disappeared. Anderson adds, that when the *Bambusa gigantea* at Calcutta, after 30 years, flowered for the first time in 1891, the plants, although weakened, remained alive.

This most important statement relates to three or four species. *First*, *Bambusa Tulda* near Calcutta. It has above been stated, that in regard to its flowering habits, this species possibly may belong to the group of *Dendrocalamus strictus*. *Second*, *Dendrocalamus strictus* and possibly a second species, *D. sericeus* on Parasnâth. *Third*, *Dendrocalamus giganteus* (*Bambusa gigantea*) at Calcutta. These three or four species all belong to the class of irregularly-flowering Bamboos, and the species of this class, as far as we know at present, do not necessarily perish at flowering.

In the paper previously quoted (I. F. XII, 418) A. F. Broun gives an instance which agrees with my own experience. Near Dehra Dun, he reports, a clump of *Dendrocalamus strictus* flowered in 1881, and sent forth new, but thin shoots, in 1882. It then flowered again in 1885, and now, (1886) new scraggy and thin shoots are pushing up in the midst of the old clumps.

In the same communication, however, Broun also gives a remarkable instance of *Bambusa arundinacea*. "In Dehra" he says, "most of the clumps of this species died down immediately after flowering in 1881, but I know one case which proved an exception. In 1882, one clump sent up a number of new culms. These, however, flowered again during the present year (1886) and there is as yet no sign of new leaf-bearing culms coming up." Mr. Jasper Nicholls mentions a similar case (I. F. XXI, p. 92). In 1885, the Katang Bamboo had flowered and seeded in Rajim in the upper valley of the Mahanadi river. In 1886 all the clumps had died off, but "here and there was to be seen an exceptional stalk, and a few attenuated and almost abortive shoots had sprung up from moribund roots. These were striving to flower and seed." Twelve years ago, in March 1886, I permitted myself to draw the attention of Indian Foresters to this point (I. F. XII, p. 203). I think I may be excused for once more placing this question before them,

SEEDLINGS OF *DENDROCALAMUS STRICTUS* IN FLOWER.

Those who have had the patience to read this lengthy paper, will now be rewarded by the account of a truly sensational event, the flowering of a seedling plant of *Dendrocalamus strictus*. The history of this remarkable plant has been recorded in a Report by the Conservator of Forests, Patiala State. This report shows, that in June 1894 the seed was collected in the natural forest on dry, stony, South and South-east slopes of the outer hills near Kalka; that it was sown in the nursery at Pinjour in the beginning of March 1895. In February 1896, the plants were taken out and planted in baskets, prior to their being permanently put out into the forest. In April 1896, out of the whole lot in the baskets, five plants commenced to flower, two of these were sent to the Dehra Dún Forest School and received there in August, 1896. The remaining flowering plants were kept at Pinjour, when they died one after another within three or four months. A photograph of one of the plants sent to Dehra Dún, taken by Mr. Gleadow, is reproduced here* and shows the appearance of the plant. The following is a translation of the Conservator's Report.

1. 'The seed was collected in June 1894 from natural Bamboo Forests growing on South or South-east slopes of dry, stony, lower Hills of sub-Himalayan tracts, belonging to the Patiala State, at from 1 to 6 miles to the North-west of Kalka, and 2,000 to 3,000 feet in elevation.

2. 'These Bamboo Forests have only one species of Bamboo, which is the common male Bamboo (*Dendrocalamus strictus*).

3. 'About 15 seers of the above seed was sown in State Forest nurseries at Pinjour gardens (3½ miles S. E. of Kalka) in the beginning of March 1895.

4. 'In February 1896, all the Bamboo plants raised from above-mentioned seed and in the above-mentioned regular nurseries, when about one year of age, were transplanted into baskets 5 or 6 months prior to their being permanently put into the plantations, on the bare dry Patiala Siwaliks during the next coming rainy season. At the time of transplanting, all the plants were healthy.

5. 'In April 1896, out of the whole lot of young Bamboo plants in baskets, five Bamboo plants commenced to flower. Two plants out of five were sent to the Director of the Imperial Forest School, Dehra Dún, through P. Madho Ram Patiala student at Dehra, and three were kept at Pinjour, where they died one after another within three or four months.

PATIALA, }
7th April, 1897. }

P. SUNDER LAL PATHAK,
Conservator of Forests, Patiala State.

*See Frontispiece.

One of the flowering plants, the original of the photograph, is now before me. As already stated, it was thirteen months' old when it commenced to flower, and it was received at Dehra Dún when one month old. The rhizome is much more strongly developed than is the case in the 12 months' old plants raised at Dehra Dún described above. On the left side are the stumps of two primary shoots, which have died and dried up. At the end of one bent rhizome branch is the first stem, bearing flowers instead of leaves, while the second and slightly thicker stem is at the end of the second rhizome branch, which likewise is bent, but is much longer and stouter than the first. It is 2 inches long, and at the bend nearly half an inch in diameter. It may be remembered, that the long rhizome branches are a peculiarity of *Dendrocalamus strictus*. The remarkable feature in these flowering seedlings is, that they are nearly as thick as those of the 24 months' old plant received from Dehra Dún. It would almost appear that in the probably rich soil of the Pinjour nursery, some of the plants were induced by some specially favourable circumstance, to develop their rhizomes in an extraordinary manner, which caused these plants to produce flowers in the place of leaves.

In forwarding his report to the Director of the Forest School, the Conservator of Forests requested him to find out the extraordinary cause of the early flowering of these Bamboo plants. Mr. Gamble has most kindly transferred this request to me. At present I regret extremely my inability to explain this entirely exceptional and most remarkable case. So much, however, we may learn from it, that the action of the leaves on these five plants during the rains of 1895, was sufficient to create in them the disposition to form flower-buds in the place of leaf-buds, for the ends of the flowers which began to show themselves in April 1896, must have been formed in the previous autumn. The specimen before me has perfectly-formed flowers, generally two fertile ones in one spikelet, the six anthers are full of pollen, and in the more advanced spikelets the ovary is stout, the ovule having apparently been fertilized. It would be interesting to know whether any of these five flowering plants had produced seed, and whether any of the seed produced by them had germinated.

Possibly, in such cases, the rule holds good which has been established by Mr. Oliver and Mr. Gamble, that Bamboos which flower out of their time, do not produce perfect seed.

CONCLUSION.

Indian Foresters may ask, what can possibly be the practical advantage of studying the life-history of the Bamboo in the

manner recommended in these pages. I fancy I hear some of my younger friends say:—"Were we to set to work to make experiments, to record our observations in the forests, and to publish the results, we should be put down as theoretical scientists, and that might interfere with our advancement in the service. For our own prospects it is much better to attend to business and to produce a large surplus revenue from the forests entrusted to our charge. We are practical men, and we desire to see a tangible result of our labours."

My reply is, that as a matter of fact, Bamboos produce a very large proportion of the surplus forest revenue in India, and that this proportion is certain to increase. The forests of *Dendrocalamus strictus* between the Sutlej and Sarda are probably at this time being worked to the full extent of their productive powers. Many millions of stems are brought down annually, in order to provide for the requirements of the plains of Northern India. If by more skilful management these forests could be made to produce larger quantities, there would be no difficulty in disposing of the produce. In Burma, at present, the more accessible forests yield all the Bamboos which the open country requires, but with the increasing population and increasing prosperity, the demand for Bamboos is growing steadily, and here, as well as in other provinces, the question of systematic management of Bamboo Forests must, in course of time, arise.

Nor ought we to lose sight of the Bamboo paper question. That question came up in India at the time of the Forest Conference of 1875; from that time until about 1882, it has occupied the attention of Indian Forest Officers, and has frequently filled the pages of the "Indian Forester." About 20 years ago, Mr. Thomas Routledge, of Sunderland, the chief agitator in this matter, himself came to India, armed with the best recommendations to persons in high and influential position. Rags had long ceased to supply sufficient quantities of stock for the rapidly growing requirements of the paper mills. Esparto grass had come into use on a very large scale, but even this new source of supply was insufficient to meet the demands of the paper manufacturer. In China, it was well known, excellent paper had always been made from Bamboo fibre. The prosperity of the British paper mills seemed at stake, hence the demand seemed justified that the Bamboo Forests of India should be thrown open to private enterprise, in order to save the starving paper mills. Fortunately, Indian Foresters in those days had studied the life-history of Bamboos, and they succeeded in convincing Mr. Routledge, that to collect the young shoots from the natural forests when they spring up in the rains and to transport them to the mill, would not pay. The question, therefore, of making over large areas of the natural forests to the

manufacturers of paper stock was not pressed, and the proposal was made instead, that Government should establish Bamboo plantations on a large scale, where, by means of manure and irrigation, the Bamboo clumps should be induced to produce larger numbers of fresh shoots, not at one season only, but throughout the year.

About that time, however, the manufacture of paper stock (wood pulp and cellulose) from Spruce timber had been developed mainly in Germany and Sweden, and the supply of this new material brought relief to the British Paper Mills. Wherever there are forests of Spruce and allied species, in Europe and in North America, the manufacture of paper stock from timber is progressing on a constantly increasing scale.

Nevertheless, Bamboo fibre is far superior for the manufacture of paper to Spruce timber, and there seems little doubt, that the Bamboo paper question is destined to be re-opened. As a matter of fact, Mr. Bourdillon reports (Gamble, p. 126) that the Iral or Elephant grass, *Ochlandra travancorica*, makes a splendid paper, and that a paper mill in Travancore uses it almost exclusively.

Hitherto it has generally been assumed that Bamboo paper can only be made from fresh shoots while soft, and before they are hardened by the deposition of silica. There seems no doubt, however, that in China the dry stems also are used for that purpose. Whether, on account of the large quantity of chemicals required, this may be commercially feasible in the case of the Indian species or not, the manufacture of Bamboo paper has a future in India. The question, whether the production of fresh shoots can be stimulated by manure and irrigation, and whether the removal of these fresh shoots will not weaken the productiveness of the rhizome, ought to be studied beforehand so that, when the Bamboo paper question again becomes pressing, Indian Foresters may have at their disposal the needful knowledge and experience. People who pride themselves on being practical, may be disposed to fight shy of work which is not likely to pay immediately. In the case of Bamboo they will further their own interests by looking ahead a little. Knowledge is power in this as in all other matters, and a thorough study of the life-history of Bamboos will pay in the end.

Wire rope-way.

The wire rope-way at Mount Stuart is intended to take small scantlings sawn at the mills, to the plains, whence they can be carted to the railway. It consists of one single large

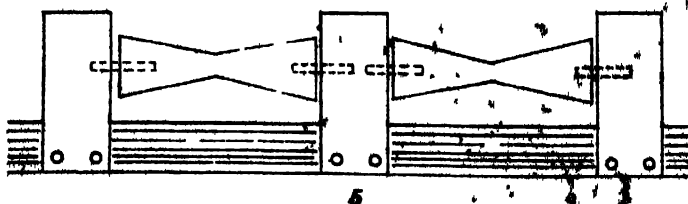
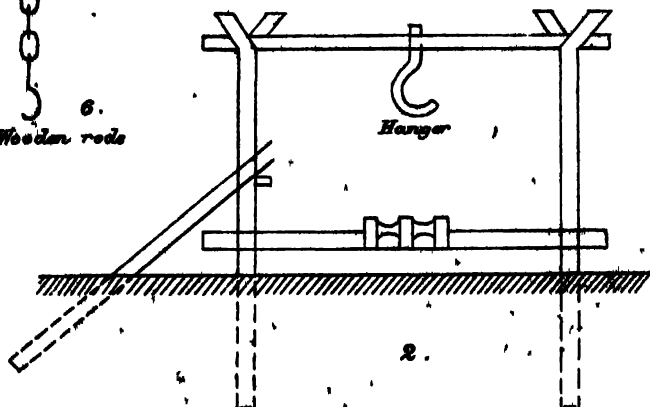
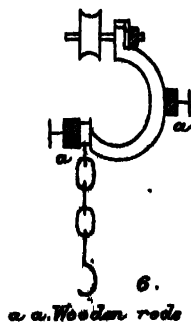
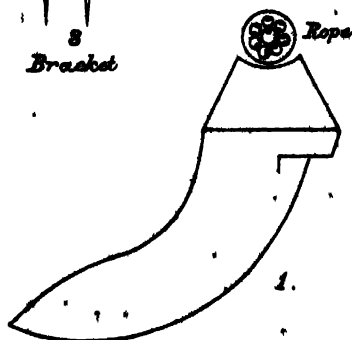
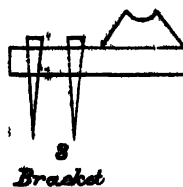
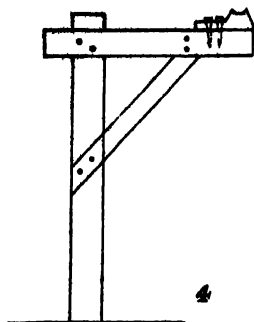
rope, carried on supports, anchored at both ends and provided with tightening gear at the lower end, and one endless hauling rope, passing round a wheel at the lower end, and round a brake drum at the upper end. Cradles travel up and down the single rope, clipped on to the hauling rope, the loaded cradle going down, hauling up the empty cradle. The maximum load for a cradle is $\frac{1}{2}$ a ton.

There is also a subsidiary rope, about 100 yards long, for conveying the scantlings from the tram trucks to the starting platform where the cradles are loaded. The length of the rope-way is a little over 6,000 ft., and the fall exceeds 1,000 ft.

The large rope came out on a huge reel ; a strong iron axle was run through this reel, which was placed in position at the foot of the hills, the ends of the axle being supported on strong wooden posts, grooved for the axle to fit in, and firmly imbedded in the ground. A large body of coolies was collected, the idea being that a man should hold the rope every thirty or forty feet, so as to distribute the weight, and thus lay it out up the hill as it ran off the reel. But, owing to the unevenness of the ground this plan did not answer ; when the head of the rope had progressed some distance, men further back, descending into ravines found the rope torn out of their hands and carried far over their heads ; it is possible that if the leaders had halted occasionally there would have been sufficient slack to follow the lie of the ground, but the danger of kinking the rope would have been much increased ; as soon as a wire rope gets at all slack, it folds over on itself, and unless the fold is immediately undone it is pulled into a twist or kink, which may seriously damage the rope, breaking some of its component wires. Three twists actually did take place, but were subsequently hammered out, and no permanent damage was done. As the distance from the reel increased, the power required to drag the head of the rope up also increased, and it eventually reached the top, hauled by seven elephants and a crowd of coolies ; so great was the strain that if one or two elephants ceased pulling for a second, the others were all hauled backwards.

At the top, a huge rock had been placed in a pit, and an anchor bar fixed in the rock ; a short cable was attached to the anchor bar, passed round the rock, and fastened to the end of the rope ; the pit was then filled with stones and earth and a mound, 3 feet high, piled on the top of it.

The lower end of the rope was attached to a tightening gear consisting of one treble and one double pulley, one attached to a cable fixed to a rock in a similar manner to the cable at the upper end of the rope, the other attached to the lower



end of the rope itself; a small flexible wire rope ran through the pulleys, and power was applied by means of a winch fastened to beams let into the ground.

The tightening of the rope was a long and troublesome job, the tightening gear had to be laid out full length on the ground, the main rope made fast to it, and then the winch worked till the two pulleys had been brought close together; the main rope had then to be made fast to trees or logs, the tightening gear taken off it, laid out again at full length, again attached to the main rope and again hauled in; the operation had to be repeated two or three times in order to get the main rope sufficiently taut.

But before the rope was finally tightened it had to be placed on intermediate supports; the configuration of the ground made it impossible to have one long span, as the ground descends in gigantic steps. At the upper end of the rope, it was passed over supports on a platform 34 feet above ground level, in order to ensure a sufficient fall to give the cradle a good start; below this platform it was supported at intervals either on hangers, or on brackets; the former being of cast iron in the shape of a large G., the upper end being provided with a loop through which a pole could be passed, while on the lower lip there was a raised groove for the rope to lie in, with bevelled sides, to allow the grooved wheels of the cradle to pass (Fig. 1). These hangers, fixed on poles, were raised to the required height either on forks of standing trees, or on long stout poles firmly set into the ground and strengthened when necessary by side-props (Fig. 2).

The brackets were also of cast iron and consisted of the groove with bevelled sides described above, on a projecting base with nail holes in it, (Fig. 3) these were fixed on the top of gallows arms, either nailed to standing trees, or to posts firmly imbedded in the ground (Fig. 4).



The height of these hangers and brackets above ground level varied from 7 to 35 feet. Every one of them had to be carefully adjusted exactly in the line of the rope, and as the rope did not behave exactly as was expected, several changes in the number and height of the supports had to be made after the rope was tightened; finally there were 25 supports in all, two of which were on bare rock, where the erection of posts was almost impossible; in these places double-headed rails were used for uprights fixed in holes out in the rock, and held tight by Portland cement.

The hauling rope was taken up the hill in the same manner as the large rope, but being much smaller and lighter, only one elephant was required, and that only near the top;

had more coolies been available, the elephant's services could have been entirely dispensed with. This rope was passed over rollers, at intervals, and grooved wheels on the terminal platform; the rollers were of *Terminalia tomentosa*, about 18" long, 6" diameter at each end, and 3" diameter at centre, shaped like a dice box; they were arranged in couples, side by side, one to carry the up, the other the down hauling rope; for axles, they had 6 inch lengths of rod iron fixed at each end, half of the axles protruded and worked in holes in wooden blocks which were secured to a long rafter fixed to the uprights of the hangers, or to specially erected posts as required, care being taken to allow a six feet clear way for the cradle between hangers and rollers (Fig. 5).

The hauling rope, after passing over the platform, was passed four times round the brake drum, and then back on to the platform, where it was made fast to a cradle, and a couple of sleepers having been fixed on to the cradle it was thought that the weight would take the cradle and hauling rope down to the foot of the hills. But after proceeding about 15 feet, just enough to get a good strain on the rope, it stopped, and it was only by means of much hauling and pulling and shouting that it was induced to descend by slow and jerky stages. There were two reasons for this; (1) it had the whole weight (814 lbs.) of the up hauling rope against it; (2) the rollers over which the up rope passed were unsatisfactory and gave rise to much friction; in fact the rope cut deeply into many of them in spite of the hardness of the wood. Eventually, the hauling rope reached the foot of the hills again, and then the two ends had to be spliced. A good splice is invisible and is the strongest part of the rope; it is thirty feet in length and is made by removing alternate strands from one end of the rope and laying strands from the other end in their places, finishing up by forcing 2 feet, 6 inches of each strand into the centre of the rope, in place of the hemp core which always exists there. The hauling rope had five strands, so three from end A had to be laid into end B, and two from end B into end A. Two amateurs spent a happy day over the job, and by evening the splice was made, but was not invisible, far from it, nevertheless it has proved itself capable of standing all the strain that will be thrown on it.

The endless rope was then passed over the wheel at the foot and the rope-way was ready for work, but the friction on the rollers, especially where there was a change from a gentle to a steep gradient, was so great that hitherto it has not been possible to work it; an improved kind of roller is to re-place the rough ones above described which will, it is hoped, enable the hauling rope to run easily. The fixing of

the spot at which the up and down cradles pass each other, and the erection of an arrangement to enable them to pass cannot be undertaken till the cradles run easily.

The brake drum consists of a horizontal wheel, 4 feet in diameter, supported on a wooden frame-work built into the ground; it has two flanges, one faced with wood, on which the hauling rope runs, the other of iron, on which the brake strap works; the brake strap is a long strip of iron with wooden blocks bolted on, iron and blocks being curved to fit half round the flange of the wheel; one end of the strap is bolted to the frame-work of the wheel, the other is connected with a lever, the depression of which presses the wooden blocks against the face of the wheel.

The cradle consists of two small deeply-grooved wheels, from the sides of which hang curved iron brackets, shaped like the figure 5; these are connected by wooden rods or bars which carry the screw clips for fixing on the up or down hauling rope. From the toe of each bracket hangs a short chain about three feet long which is tied round the load (Fig. 6).

The turning wheel at the foot of the rope is merely a large iron wheel, 5 feet in diameter, with a deeply-grooved face; it is mounted in the same way as the brake drum above described, and like it, has two small guide wheels to keep the hauling rope in place. During thundery weather any one touching the hauling rope is likely to receive an electric shock; several have been felt already, and though not strong enough to do any harm, there is no saying what their strength might be in a bad storm.

F. A. L.

II.—CORRESPONDENCE.

Method in Fire Conservancy.

SIR,

I quite agree with "H—H," who in his interesting paper in the November number on the above subject, implies that there ought to be a sort of Departmental Fire Code.

The question whether fire traces are of value in themselves or not, is rather doubtful, for in the whole course of my experience, extending over 15 years, I have only once found them of use in checking the onward march of a fire. Where fire-watchers are maintained there ought not, it is thought, to be many, if any, fire lines required: but perhaps it would be fatal

to effective fire conservancy if they were done away with altogether, as the people and subordinates would run away with the idea that fire-protection was no longer necessary, and the jungle would be burnt from end to end. The burning of fire traces, therefore, has a good moral effect on the people, if they do no other actual good.

In my division, fire traces are annually taken under existing orders, but nine-tenths of the fires originate within the traces, which means that fires are intentionally lighted, so under the circumstances it is not more economical to employ fire-watchers only who would extinguish a fire as soon as one was observed. Probably not more than 100 or 200 acres would be burnt in my division, at any rate, before the fire was extinguished, whereas the fire traces are intended to protect 500-acre blocks.

The best mode of suppressing fires is to get the culprits who fire the forests, brought to justice and punished; and to attain this end the subordinate staff should be heavily fined if they fail to trace the offender or offenders. This course has been found to be very salutary during the past two or three years. In order to encourage the detection of offenders, subordinates should be given special promotion on a small reward when any one of them is successful in arresting incendiaries.

In districts where fire traces are considered to be absolutely essential, they ought to be systematically laid down and cleared of all grass and growth, and each year coloured maps ought to be drawn up showing the fire-swept area. The Working Plans Officer in my opinion is the proper authority to lay down the direction of the fire traces. Divisional Forest Officers have too many administrative duties to perform to attend to this detail. At least this is what I find to be the case.

G. E. M.

A singular but dangerous custom.

SIR,

A curious custom, known as *budna*, and consisting in the sacrifice of a large number of animals by setting fire to the jungle in order to obtain offspring or cure from disease, was reported from the Jubbulpore Division as being prevalent among the local tribes. Enquiry was accordingly made in the other seven districts composing this circle as to its prevalence, with the following result.

In Narsinghpur the custom exists, but would appear to be dying out.

In Betul also it is known, but, as the Divisional Officer states, is "gradually losing ground. No one dares to avow 'it publicly.'" A case of incendiarism due to this cause was prosecuted many years ago.

In Nimar the custom has been heard of, more especially in connection with the cure of disease. Barren women have sometimes been known to set fire even to houses in order to obtain children.

In Mandla it is now rarely practised, though it appears to have been fairly common 20 to 30 years ago. In this district ordinary sacrifices of pigs and fowls are also termed *budna*.

The Divisional Officer, Damoh, has never heard of the custom, although the present Divisional Officer of Betul knew that it was practised when he was in charge of Damoh about three years ago.

The Divisional Officer of Hoshangabad is unaware of its existence there, the nearest approach to it being the sacrifice of domestic animals by Gonds and Korkus when disease breaks out among them.

In Sauror the custom is apparently unknown, probably because the population is largely of Aryan origin.

It would be interesting to learn whether this dangerous and destructive custom is practised in other parts of India. I feel sure that a great many of our forest fires are attributable to it.

CAMP MANDLA,
3rd December, 1898. }

E. E. FERNANDEZ.

III.—OFFICIAL PAPERS & INTELLIGENCE.

The Assam Forest Report for 1896-97.

In our number for June 1898, we reviewed briefly this Forest Report but at that time the review by the Government of India was not before us. The review has now been received and as it lays down important principles, we think it only right to give it in full.

The Government of India have read with interest your Resolution on the Progress Report of Forest Administration in Assam for 1896-97, which was forwarded under cover of Mr. Melitus' letter No. 29 Forests—1059-R., dated the 21st March, 1898. The Resolution contains a full exposition of the forest policy that you desire to follow in Assam, in regard to which I am directed to make the following remarks.

2. The Government of India fully sympathise with your desire to encourage the development of the province of which you have been placed in charge, by stimulating the breaking up and bringing under cultivation of the vast areas which are still available for the plough. They have cordially supported your proposals for the revision of the terms upon which grantees of waste-land are charged for the timber standing upon their grants, and indeed suggested a greater leniency in the matter than you were prepared to accept. They have relinquished for purposes of cultivation considerable areas of reserved forest; and in no case have they refused sanction to any proposal made by you for disforestation; though they have in two cases requested that the area which it was proposed to disforest should be examined, and its value from a forest point of view ascertained, before they passed final orders. And they entirely agree with you that unclassified forests, when, after proper examination, it has been decided that they are not worth reserving, should be made available for the extension of cultivation, absolutely without restraint.

But they gather from the Resolution under consideration that you are of opinion that the same principle should, for the present at any rate, be applied to reserved forests also, since for many years to come no danger to the forest interests of the province can arise from its application. And as the Government of India are not prepared to accept this view without reservation, they think it right to examine, in a general manner, the figures and arguments by which you support it.

3. According to the figures given in the annual report and in your Resolution, that portion of the province for which statistics are available contains 3 681 square miles of reserves, and 11,244 square miles of culturable waste at the disposal of Government and at present entered in the returns as unclassified forests, or 18·4 per cent. and 56·8 per cent. respectively of the total area, exclusive of land covered by water or for other reasons not available for either agriculture or forest purposes. The area of 19,000 square miles which is included in the wild hill tracts or in the permanently settled estates for which no returns are available, and of 4,000 square miles comprised in Native States, may, if taken together, perhaps be presumed to contain a somewhat similar proportion of culturable waste. If this be so, the province contains some 28,000 square miles of land which is culturable but not yet cultivated, in addition to the 3,681 square miles which have been constituted reserved forests, and which only form 8·11 per cent. of its total area.

4. It is, in the opinion of the Government of India, the latter area alone, and not the former, which can properly

be characterised as "forest area" for the purposes of this discussion; and a neglect of this distinction seems to them to render the argument in paragraph 17 of your Resolution somewhat beside the mark. How little of the former area is of any considerable value from a forest point of view, is apparent from the very limited nature of the proposals which you find it will be advisable to make for the reservation of further portions of it; and the Government of India, as already remarked, entirely agree with you that, subject to such proposals made after due examination and consideration, the whole of this area should be held to be available for cultivation. But, *prima facie* and in the absence of special conditions which will doubtless justify local departures from the general principle, it is from this area, and not from the comparatively small area of reserved forest, that the demands of the cultivators should first be met.

5. The Government of India hesitate to accept the view which seems to be adopted in your Resolution that the agricultural development of the province can only be fully secured by entrenching on the present area of reserved forests. In paragraph 19 of his "Suggestions regarding Forest Administration in Assam" (1879), Sir Dietrich Brandis recorded that in 1878, 587,409 acres were held by tea planters, of which 147,840 acres were planted, 439,569 acres remaining under forest. In 1896 the area occupied by tea planters had increased to 1,131,807 acres, of which 292,000 acres are shown as planted. There has, therefore, been an increase of 225 square miles in tea cultivation during the last 18 years. In 1884-85 the total cultivated area of the province was approximately 1,523,000 acres. In 1895-96 it was 1,692,000 acres. The increase in the eleven years was thus only 265 square miles on these figures. The increase is no doubt small, and though it may be unhesitatingly conceded that, on the completion of the railways which have recently been undertaken or projected, a much more rapid rate of progress may be anticipated in the immediate future, the agricultural expansion of the province may, in the opinion of the Government of India, be provided for out of the enormous area of waste which has not been constituted reserved forest.

6. But, however this may be, and for however long the complete development of the province may be postponed, the Government of India consider that it is incumbent upon all concerned to look forward to the time when that complete development shall have been reached, and to take care, while the matter is wholly in their hands, that the ultimate needs of a fully populated Assam are not sacrificed in order to secure a slight acceleration in its development; and with this end in view, they must insist that before any portion of the

existing reserves is disforested, it shall be properly examined in order to ascertain its forest value, and the question whether it will not be needed to supply future forest requirements shall be seriously considered and decided. It is an admitted fact that many of the existing reservations were made hastily and without detailed examination; and it may well be that considerable portions of them are not worth retaining as forest. Similarly, any tracts not at present reserved which may contain valuable forest areas should be examined as opportunity offers, and such portions of them reserved as may be required to complete the forest insurance of the province. It may well be that such areas are few and of small extent. But in both cases the facts must be ascertained and not assumed. In letter No. 762-F. of the 10th August 1897, the Government of India wrote:—

“They think that both questions should be taken up systematically for each district in turn, and that they should be taken up at once, before grants have been allowed to cut up areas which otherwise it might have been desirable to reserve; and they are strongly of opinion that a decision once arrived at, after due consideration and examination of the area of any reserve, should not be lightly departed from in the future. There is no doubt a great temptation to reconsider, under the pressure of applicants and the desire to develop the province, a decision to reserve any particular area; for the best forest-land will often be the best land for tea also, and it is not always easy for the Local Administration to hold the scales evenly between present demands and the requirements of the future. But the Government of India think that the fact should be steadily borne in mind that if the future forest requirements of Assam, when developed, are not safeguarded before the development takes place, there is a danger of their being sacrificed for ever.”

It must be remembered that the principle enunciated in the Government India's Circular No. 22 F., of the 19th October 1894, which you quote with approval, that wherever an effective demand for cultivable land exists, and can be supplied *only* from forest areas (a condition which, as regards reserved forests, can hardly be of frequent occurrence in Assam), the land should ordinarily be relinquished without hesitation, is subject to the condition, to which your attention was expressly drawn in the review of last year's Forest Report, that cultivation must not be allowed so to extend as to encroach upon the minimum area of forest which is needed in order to supply the general forest needs of the country, or the reasonable forest requirements, present *and prospective*, of the neighbourhood in which it is situated. The bringing under cultivation of the large area of the unclassed forests from which the forest needs of the people are at present mainly supplied will abolish this

source of supply ; and the population of the province will then be chiefly or wholly dependent upon the reserved areas for those larger requirements which the higher standard of living that will accompany development may be expected to create.

7. The Government of India have read with some concern in the Conservator's report that in the Garo Hills some very fine sâl tracts have, since 1890, been wholly cleared by shifting cultivation. These sâl areas, though at present perhaps inaccessible to the market, will doubtless become of great value as the province is further opened out ; and if the reservation of selected portions should, for local reasons be inadvisable, some means should be found and adopted to protect the valuable trees from destruction.

8. You criticize unfavourably the measures adopted for the exploitation of forest produce, and the Government of India are inclined to agree that a certain want of enterprise in this direction has been exhibited by the Forest Department. The quantity of timber removed by departmental agency fell during the year by 50 per cent, and the question whether this fact should be regarded as unsatisfactory would appear to depend, partly upon whether the present state of the market is such as to justify more extended operations, and partly upon the immediate prospects of an increased demand at higher rates. The Government of India agree with you that the tendency of past forest administration in Assam has been to hold out for rates which the state of the market does not justify, and so to unduly limit the sale of a property which gradually deteriorates in value. But in particular cases, such as that of Goalpara, it is necessary to take future prospects into consideration. It appears that the price of timber in the Goalpara Division depôt fell from Rs. 47-14 to Rs. 38-18 per ton. Taking the average cost per ton of sâl delivered at the depôts at Rs. 18-8, this would involve a reduction of the net profit from Rs 34-6 to Rs. 25-5 per ton. It is evident that it would pay Government to reduce considerably even these latter rates, if the sale of the whole annual yield of the Goalpara reserved forests, estimated at 6,000 trees or perhaps 4,500 tons, could be thus insured, and if no prospect of higher rates in the immediate future existed. But the lowness of the royalty which it is found possible to levy at present is mainly due to the inaccessibility of these forests and the consequent cost of transport of timber to the market ; and as soon as these forests are opened out by the railway (as must probably be the case within no very long period), these difficulties will disappear, and the value of the timber will then be very greatly increased. It is understood that since the working-plan was sanctioned, the trees which might have been cut in accordance with its provisions have accumulated to the number of 19,550 ; and it is probable that when a demand for this timber arises, not less than 12,000 tons will be at once available. Thus

the prospects of certain profits in the near future should be carefully considered before a general reduction of the rates in these reserves is decided upon. The royalty rates for pyinkado in Burma refer to trees grown in unclassed forests, and a comparison between these and the net profits expected to be realized in the Goalpara reserve is hardly to the point. Moreover, the rate of Rs 47, charged by the Assam Forest Department for sál is apparently taken from paragraph 84 of the Forest Report for 1895-96, the figures in which refer to sales in depôts, and the price quoted includes the cost of felling, logging, and transport by land and water.

9. The Government of India entirely agree that every effort should be made to remove all grounds for accusation against the Forest Department, whether just or unjust, of adopting an unsympathetic attitude towards the saw-mill industry in the province. The royalty per tea-box converted by these mills amounts, however, according to the figures given in the margin of paragraph 13 of the Resolution, to only ten pies per box; and considering that the price paid for boxes containing $\frac{3}{4}$ ths of a cubic foot is Rs. 1-10, it would hardly seem that this small charge can materially affect the competition with Norway and Japan. The reason for failure must apparently be looked for in some other direction. The Government of India observe with satisfaction that the subject is under special consideration, and that the tea-box industry has increased during the last four years by 12 per cent.

10. The Government of India fail to understand the great increase in the number of poles and the amount of fuel which are said to have been removed under *garkati* permits, as it is understood from notification No. 80, dated the 9th October, 1883, and from paragraph 12 of the present Resolution that these permits cover minor forest produce only. A further explanation is, as you point out, most desirable.

11. The financial results of the year were satisfactory. You point out that these results greatly depend upon the valuation of timber on waste-land grants. This is doubtless the case; but it must be remembered that an inevitable result of liberality in this valuation (and the Government of India are in favour of liberality) must be that large quantities of cheap timber are thrown upon the market or otherwise brought into consumption, a fact which must effect forest revenue unfavourably.

12. In conclusion I am to convey the acknowledgments of the Government of India for your interesting and exhaustive Resolution, and for the keen interest which you display in the forest administration of your province. You have entered into the general question of policy with somewhat greater fulness than is usual in an Administration Report, and the Government of India have therefore thought it well to express their own views with equal fulness. They are of opinion that the forest

policy which is plainly indicated for Assam is great liberality as regards unclassed forests and their produce, and the most scrupulously conservative treatment of the reserves. I am to request that the same publicity may be given to this letter as was given to the Resolution which it reviews.

IV.—REVIEW.

Review of Forest Administration in British India for 1896-97.

By B. RIBBENTROP, C. I. E., INSPECTOR-GENERAL OF FORESTS.

We propose, in accordance with our usual custom, to place before our readers the important question treated in this summary of the work of a year which is gone, together with any extracts which may be interesting, before we commence to give our usual accounts of the Provincial Reports of the past year (1897-98) which are now fast coming in.

Area.—The area of State forests under the Forest Department in India at the end of 1896-97 was

		square miles.
Reserved Forest	...	79,811
Protected "	...	9,024
Unclassed "	...	25,582
Total		113,917

which is an increase of 1,406 square miles on the area given in 1895-96. The Provincial areas are, in order

		square miles
Central Provinces	...	19,610
Madras	...	18,907
Bombay	...	15,015
Assam	...	14,925
Burma	...	14,058
Bengal	...	13,288
Punjab	...	6,816
Berar	...	4,179
N.-W. P. and Oudh	...	3,959
Andamans	...	1,953
Coorg	...	888
Baluchistan	...	170
Ajmere	...	149

The Reserved Forests form 70 per cent. of this area, and the forest area is a little less than 18 per cent. of the whole area of the provinces mentioned.

Forest Settlement.—The following extract gives an account of the progress of the work and shows how much there still remains to be done.

“In most provinces the selection and settlement of the areas to be maintained as permanent Forest estates is nearing completion, and in cases, as in the Central Provinces, the settlement work remaining is confined to that connected with the excision of areas to be given up for cultivation. In Upper Burma, Bengal and Madras alone do large areas still remain to be dealt with. In Burma much good progress was made, resulting in the final settlement of 1,406 square miles. At the close of the year no less than 4,800 square miles were in various stages of settlement, and further tracts in the Upper Chindwin, Myittha, Ruby Mines, and Shan States Divisions had been examined with a view to their settlement. In the Punjab, the conclusion of the Kangra settlement, which added an area of 707 square miles to Protected forests, is the chief feature of the year. In Madras 845 square miles were finally notified, and 4,019 square miles were undergoing settlement at the close of the year. It is estimated that there remain some 4,000 square miles still to be taken in hand, and the work will probably take another five years to complete. In Bombay 820 square miles were finally notified reserves. The chief work remaining is in the Southern Circle, where some 1,100 square miles remained to be dealt with at the close of the year.”

Demarcation.—An interesting table gives the statistics of demarcation as follows :—

	miles.
Length of artificial boundaries	... 103,228
„ boundaries not demarcated	... 18,417
„ naturally demarcated and not requiring marks	... 15,661
Total	... 137,306

The new work of the year amounted to 6,428 miles, and the expenditure of the year was Rs. 56,401 on new work, and Rs. 55,521 on repairs, total Rs. 1,11,922. The cost of new work on the average was Rs. 8-12 per mile.

Surveys.—In addition to the Special Forest Survey Branch, five parties of the Survey of India Department were at work. The total area done was 4,823 square miles, of which 1,563 square miles by the Imperial Forest Survey Branch. A useful map shows the gradual progress of this very important work, with special reference to the year.

Working Plans.—In the Bengal Presidency, Working Plans are in force over 13,737 square miles, or 17 per cent. of the area. During the year 21 plans were sanctioned, 28 plans were submitted for orders and preliminary proposals were examined for 27 more. Mr. Ribbentrop remarks that "it is satisfactory to observe that at the same time a considerable improvement has been attained in the character of the plans proposed, which are now much more simple and more practical than those which were first prepared. As regards the due observance of the provisions of existing plans, it may be said that they are more and more strictly carried out as experience and a properly trained executive staff enables the controlling officers to better carry out the works laid down."

Communications and Buildings.—It is interesting to note the amounts spent on these works. They were :—

		New works.	Repairs.	Total.
Roads	Rs.	75,155	89,812	1,64,967
Buildings	"	1,81,219	78,899	2,60,118
Total	„	2,56,374	1,68,711	4,25,085

This is very much as it should be : roads to enable the produce of the forests to be exported and to facilitate supervision and protection ; and buildings to house the staff and diminish the liability to illness to which forest officers of all grades are naturally so much exposed, are works of the highest importance, and in some provinces have been far too much neglected. The largest expenditure was in Madras, the next in the N.-W. P. and Oudh, while the Central Provinces with its huge forest area is far behind ; and even the Punjab, in spite of its hill transport works, shows only a comparatively small sum.

Last year (March No. 1898, Vol. XXIV) we drew attention to the difficulty in estimating the value of forest tramways by comparison with cart carriage, and this year we find the Inspector-General saying much the same thing. He remarks :

"Under tramways there is little of interest to add to the remarks made in the Review for the year 1895-96. The existing tramways in the Punjab, Andamans and Madras continued to yield useful service. In this connection it is observed that the working of the tramway in South Coimbatore is stated to have resulted in a loss of Rs. 22,973, as compared with what the cost would have been if country carts had been employed. But it appears that without the tramway the wood could not be exported at all, carts not being available or very deficient in number. Under such circumstances,

'calculations of the kind are meaningless, and it would be more
'correct to credit the tramway with the net profit which has
'been realized from the sale of the otherwise unexploitable wood."

General Protection.—Mr. Ribbentrop notices the decrease in the number of cases of forest offences; both those taken into Court and those compounded and records that the number of convictions remains above 80 per cent. This is satisfactory, but it is strange that the number of cases should vary so in different provinces. There were 9,818 in Madras, 7,325 in Bombay, 4,285 in the Central Provinces, and so on, while in the N.-W. P. and Oudh there were only 637. We submit that this seems to show that in those Provinces where forest work has longest been organized and where systematic management has made most progress, forest crime is less.

Protection from fire.—This chapter is very interesting and might almost be quoted *in extenso*. The area attempted during the year was 30,897 square miles and of this area 29,364 successfully, the failures being only about 5 per cent. The total cost was Rs. 3,03,688.

Mr. Ribbentrop then proceeds to discuss the question, which has been a good deal ventilated in our own columns, of the value of fire-protection, especially in the teak forests of Burma. His views were published by us last year (April number 1898, Vol. XXIV) and need not be repeated now, but we are glad to see that the final result is "very conclusive that 'fire-protection is essential to the growth of sound teak, at all 'events in the earlier stages." We quote also the following interesting experiences:—

"The report by Mr. Corbett, Deputy Conservator in the 'Tharrawaddy Division, supplies the most valuable and interesting information. By examination and comparison of similar 'forests outside, but adjoining, the fire-trace and the nearest 'area inside the trace, he found that outside fire-traces the 'number of teak trees under six feet in height is certainly 'more than double the number inside the fire-trace on an equal 'area. Inside the fire-trace, however, the plants were almost 'invariably seedlings, whilst outside about one plant in five was 'found to be a seedling, the rest, as was shown by the size 'of their roots, had been burnt back year after year and 'were in many cases from 20 to 30 years old.

"This explains why it was accepted that reproduction 'was more favourable outside than inside the protected area. 'Of plants, however, between 6 to 20 feet high, he reports that 'there were, roughly speaking, about three times as many 'inside the fire-trace as there were outside; inside the fire-trace 'the plants were as a rule well grown, whilst outside they 'had almost invariably been damaged by, or showed signs of, 'the effect of, the fire."

'No better proof could be required of the beneficial influence of fire-protection on reproduction and the growth of the young plant. Even at a more advanced stage, the teak is not so unsusceptible to the effects of fire as has been frequently assumed, and observations have tended to prove that dead teak trees of all ages are more frequently found in exposed than in protected forests.

'Some interesting experiments have also been made as regards the comparative rate of growth of teak trees in fire-protected and exposed areas in the Tharrawaddy Division in Burma. Thirty-seven trees, measuring between 1 ft. 4 in. and 2 ft. 4 in. in girth, growing under protection, and an equal number growing in areas exposed to annual conflagration were analysed. The analysis shows a total radial increase for the 37 trees inside the fire-belt of 15·91 in. during six years, against 10·28 in. for those outside. The measurements were made on four radii—north, south, east and west—and the average recorded."

Working and Outturn.—The general results of the year came, for all classes of forest, to

Timber and Fuel	... cft.	154,252,846
Bamboos	... No.	110,718,522
Minor Produce	... Rs.	26,28,599

The removals by Government Agency were :

Timber	... cft.	7,449,433
Fuel	... cft.	18,962,489
Bamboos	... No.	910,909
Minor Produce	... Rs.	2,29,781

and by purchasers :

Timber	... cft.	39,577,542
Fuel	... cft.	85,875,357
Bamboos	... No.	133,979,895
Minor Produce	.. Rs.	29,87,069

The outturn of teak from the forests of Burma came to 68,980 tons extracted by Government agency, and 2,09,070 tons by purchasers and lessees. The value of minor produce from Burma decreased, owing, it is said, to destruction of the India-rubber trees by over-tapping.

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Financial results.—The following are the figures for the 'financial' year. (We note that in this Report the 'forest' year is disregarded, it might, therefore, be now given up to the great simplification of our reports and returns.)

			Rs.
Revenue	...	...	1,78,56,510
Expenditure	...	...	1,00,45,150
Surplus			78,11,360

the gross revenue being the highest on record and the net revenue higher than in any previous year except one (1893-94).

The amount at which the forest produce given away free or at reduced rates is estimated was Rs. 37,46,500 so that the net value of the year's work was Rs. 115,57,860. Mr. Ribbentrop points out that more than 17 per cent. of the years' outturn was given away free of charge. Of the 37½ lakhs so given, 9 were in Bombay, 7 in the Punjab 3½ in Berar, 4½ in Burma, 2½ in the N.-W. P. and Oudh and 2½ in Bengal and the Central Provinces.

All the chief provinces showed a good surplus revenue except the Central Provinces, the reasons for the falling off in which we have before discussed. Though we are very far from thinking that the work of the Department should be judged chiefly by its balance sheet, yet the Central Provinces' deficit question seems to require some enquiry and remedy, for the figures do not seem to be due entirely to the famine.

The following table of quinquennial results is interesting and deserves to be reproduced.

Quinquennial periods.			Gross Revenue.	Expenditure.	Proportion of Expenditure to gross Revenue.
			Rs.	Rs.	Per cent.
1871-72 to 1875-76	...	...	63,21,499	42,19,379	67
1876-77 to 1880-81	...	...	68,59,663	47,30,178	69
1881-82 to 1885-86	...	...	1,02,04,364	64,95,993	64
1886-87 to 1890-91	...	...	1,34,43,186	78,21,672	58
1891-92 to 1895-96	...	...	1,66,72,525	91,29,400	55

Experiments.—It is noted that the plantations of *Robinia Pseudo-acacia* in the Punjab continue to thrive; that a *Eucalyptus* (why is the species not told us? there are hundreds of them, and, considering how diverse they are in climatic requirements, it is important to know which are the hardy ones in any locality) plantation is being worked in coppice for fuel at Ranikhet like the old plantations in the Nilgiris; and that *Alnus nepalensis* has been of great value in re-clothing a landslip in Darjeeling (see also a paper in our number for December 1898, Vol. XXIV). This alder, however, is a hill tree entirely and the reason why it thrives on the Darjeeling landslip is that its roots are always down in the water. On the Hoshiarpur hills, it would not have this advantage and would, besides, be in a climate much too hot for it, so that we think, the Inspector-General will have to reconsider his suggestion. What the Hoshiarpur chos want, to begin with, is many years' complete rest and the most rigid exclusion of men and animals, then the natural growth will spring up, and it will be much the best to defer attempts at artificial re-stocking until it is seen how far natural re-stocking will suffice, with or without works, such as are so useful in the French Alps. It must be remembered always that the French experience was that planting on denuded slopes was a failure, and that the first thing to do is to obtain a growth of grass and herbs and shrubby plants and to get the soil somewhat improved, before plantings and sowings are attempted. The Dehra Dún resin works are the subject of the following remarks: The note by the Reporter on Economic Products will probably be re-printed in another place.

"The distillation of resin at Dehra Dún may now be said to have passed the experimental stage, and to have proved a distinct commercial success. About 1,000 maunds of crude resin were collected during the year, the trees tapped yielding an average of 10 seers each during a period of 14 months. The bulk of the crude resin is taken to Dehra Dún, where it is manufactured into colophony and turpentine, and it has been found that for each maund of resin so treated, a profit of Rs. 2 can be made. Two thousand six hundred and seventy-six maunds of crude resin yielded 1,993 maunds of colophony and 4,807 gallons of turpentine. Arrangements were commenced to start similar works in the forests of the Naini Tal Division, and 450 maunds of resin were collected. So far as the figures are available, it appears that the yield of resin from the Ranikhet pines is considerably less than that of the Jaunsar pines. Further information is, however, required on this point."

Exports of Forest Produce.—We quote this in full,

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“The following table gives the amounts and value of various articles exported from India during the year :—

ARTICLES OF FOREST-PRODUCE.	QUALITY, IN TONS OF 20 CWT; IN THE CASE OF TEAK, CUBIC TONS.		VALUATION AT PORT OF SHIPMENT IN 1896-97.	
	Average of five years 1891-92 to 1895-96.	In 1896-97.	Total.	Per ton.
Caoutchouc	453	311	8,98,488	Rs. 2,889
Lac—				
Button	1,420	1,401	18,95,911	1,353
Shell	6,005	8,788	1,19,35,957	1,358
Stick and other kinds ..	85	135	1,66,750	1,235
Lac-dye	8	...	...	...
Sandal-wood, ebony and other ornamental woods ..	Information	not available	5,91,886	...
Cutch and gambier	9,522	6,104	23,99,533	393
Myrabolams	44,120	44,968	36,14,315	80
Teak	54,503	64,221	68,64,829	107
Cardamoms	120	29	1,15,581	3,985
Total in 1896-97 ..	...	...	2,84,83,250	...
“ 1895-96 ..	...	...	3,50,15,023	...
Decrease in 1896-97	...	...	65,31,772	...

“The value of exports from the country thus fell off by ‘no less than Rs. 65,32,000 as compared with that of the ‘previous year, due almost entirely to the disastrous effects ‘of the plague and famine. The chief articles which show a ‘falling off are caoutchouc (Rs. 93,000), button lac ‘(Rs. 17,33,000), shell-lac (Rs. 26,95,000), sandal-wood, etc. ‘(Rs. 3,45,000), cutch and gambier (Rs. 14,00,000), and my- ‘rabolams (Rs. 4,00,000).

‘With regard to the exports of teak timber, the following ‘note by the Bombay-Burma Trading Corporation may be ‘quoted with advantage:—

‘Prices in the Europe market were well maintained through- ‘out the year, cargo timber (square) selling at about £12 to ‘£12 10s., whilst the price of Europe planks, ordinary market ‘specifications, advanced from £11 10s. to fully £13 10s. per ton ‘of 80 cubic feet.

‘Consumption continued at the rate of nearly 70,000 ‘tons per annum, so that, in spite of continuously heavy ship- ‘ments from Burma as well as from Siam, there has been no ‘increase in the stocks in the principal distributing centres.

‘Combined with an unusually heavy demand for ship- ‘building, specially naval constructions for the British as well

'as Foreign Governments, there has been an increased demand
'for rolling stock construction, resulting in the total con-
'sumption being considerably in excess of the average of
'previous years.

'Siam has again contributed nearly 20,000 tons of the
'import into Europe markets. The floating season, 1896-97,
'has been productive of 60,000 logs against 65,000 in the
'preceding season."

VI-EXTRACTS, NOTES AND QUERIES

Nitrogen and Plants.

The Madras Mail gives the following report of a lecture on "Atmospheric Nitrogen in its Relation to Vegetation" delivered by Dr. W. J. Leather, Agricultural Chemist to the Government of India, at the College of Agriculture, Saidapet, on Tuesday last :—

The lecturer, in introducing the subject, thought it would be as well to set out briefly the reason why it occupied, and still occupies, an important place in the field of agricultural research. Early in the history of chemistry it was determined that all plants were built up of two distinct classes of substances, one of which became dissipated on heating, while the other did not. The composition of the latter, or mineral, portion was only accurately determined later on, but it was readily recognised that the plant must rely entirely on the soil for a supply of its mineral ingredients. Regarding the portion which was dissipated on heating, it was discovered last century that this portion consisted of compounds of carbon, hydrogen, oxygen and nitrogen : and it has been known for over half a century that plants obtained the greater portion, if not the whole, of their carbon and a part of their oxygen from the atmosphere, and that most of the water entered through the root, the supplies of these substances being practically unlimited.

The question was whether plants obtained their nitrogen from the soil or from the free nitrogen of the atmosphere. The first experiment was made in 1779 by Priestly, who, working with primitive apparatus, came to the conclusion that plants assimilated the free nitrogen of the atmosphere. Twenty years later De Saussure, as the result of his experiments, came to the opposite conclusion. In 1837 Boussingault investigated the matter with indecisive results, but he again attacked the subject in a more thorough manner in 1850 and subsequent

years. He grew plants from seed, in a soil which was capable of supplying the necessary mineral matter, but which did not contain any compound of nitrogen. The whole was enclosed in a large glass sphere, which was occasionally supplied with carbon dioxide, a supply of water being given to the soil. In this way the compounds of nitrogen were, as far as possible, put out of reach of the plant, while the free nitrogen of the atmosphere was in contact with it. His experiments showed that nitrogen in the plant was practically the same in amount as that originally contained in the seed—in other words that the plant did not assimilate atmospheric nitrogen. These results were subsequently confirmed by other experimenters, notably Lawes, Gilbert and Pugh, of whose apparatus and methods of procedure the lecturer gave a detailed account with the aid of the necessary appliances.

The question could not be allowed to rest here, for there was a generally expressed opinion among British farmers that clover, in addition to producing excellent crops of hay, enriched the soil for a succeeding crop of wheat or barley, and further that all competent investigators admitted that the question, in spite of the results already mentioned, was not fully solved, while some of the field experiments seemed to confirm the British farmers' opinion. Hellriegel and Wilfarth carried out a series of investigations on the relation which existed between the amount of plant-food in the soil, and the weight of crop obtained. Plants were grown in sterilised soil in a series of pots having a good supply of plant-foods other than nitrogen. In one pot of a series there were no compounds of nitrogen present; in a second pot a small amount of combined nitrogen as sodium nitrate; in a third pot twice as much and so on. It was found that in the case of the *Graminaceæ* and some others, that the weight of plants produced depended largely on the amount of combined nitrogen supplied, but that with the *Leguminosæ* the yields varied. Further, the striking fact was demonstrated that pea plants, grown in sterilised soil, with no supply of combined nitrogen, in some cases grew luxuriantly, while in other cases their growth was limited to the supply of nitrogen in the seed. The roots of the stunted peas had developed numbers of nodular protuberances. The question was, therefore, raised, whether this phenomenon was in any way connected with the action of micro-organisms or microbes. Further experiments showed that the *Leguminosæ* did not thrive in cultivation pots from which all micro-organisms were excluded, that these plants developed nodules on their tubercles and thrived well if the cultivation pots were watered with muddy water obtained by slaking fertile soil with water, but not if this water was previously sterilised by boiling. The lecturer then described the experiments in detail and summarised the results as follows:—Plants belonging

to the natural orders *Graminaceæ*, *Cruciferae*, etc., did not assimilate atmospheric nitrogen; plants belonging to the sub-order *Papilionaceæ* (order *Leguminosæ*) assimilated atmospheric nitrogen if certain micro-organisms were present in the soil. The experiments of Hellriegel and Wilfarth have been corroborated by Lawes and Gilbert. The lecturer then proceeded to give in detail the evidence tending to prove that the nodules mentioned were due to inoculation, and said that certain bacteriologists had separated organisms from these nodules. Nobbe, it appears, has grown these organisms and has placed them on the market in suitable vessels ("Nitragin") so that soils deficient in the organisms may be supplied with them. Regarding the practical utility of "Nitragin" the information at present available seemed insufficient to base any opinion on the matter. The lecturer incidentally pointed out that some of the lower forms of vegetable life such as *Algae* and *Lichens* seemed to be capable of assimilating free nitrogen, which accounted for the phenomenon noticed by some observers that, land left apparently bare, showed an increase in the amount of nitrogen present. The question "in what way do bacteria assist certain plants in assimilating atmospheric Nitrogen" was answered by Lawes and Gilbert as follows:—"The alternative explanations of the fixation of free nitrogen seem to be:—1st, that under the conditions of the Symbiosis the plant is unable to fix the free nitrogen of the atmosphere by its leaves; 2nd, that the organisms become distributed within the soil and there fix nitrogen; the resulting nitrogenous compounds becoming available as a source of nitrogen to the roots of the plant; 3rd, that the free nitrogen is fixed in the course of the development of the organisms within the nodules, and that the resulting nitrogenous compounds are absorbed and utilised by the host." The third suggestion seemed the most likely one.

Leaving aside the purely scientific aspect of the question, the lecturer said he would like to deal with the practical side of it. It was true that through the agency of pulses the land became enriched to a certain extent for a subsequent cereal crop. But experiments carried out at Cawnpore and elsewhere showed that the root residue of a pulse crop could only be relied upon to increase the cereal which filled it by about ten per cent., which was very little compared with the increase which could be obtained by the use of nitrogenous manures. Doubtless the part played by pulse crops in India was an all-important one, but it would be folly to trust to such crops alone to replenish the soil and to neglect the use of cattle dung and other manures supplying nitrogen to the soil. The soils of India were very poor in nitrogen; and this left only one conclusion to be drawn, namely that, although our pulse crops were annually assimilating some nitrogen from the

atmosphere, the amount so brought into combination with the soil was not sufficient either to increase naturally the store of this all-important plant food, or even to maintain it at a high level.—(*Planting Opinion.*)

The Cultivation of Citronella grass in Ceylon.

The production of citronella oil has increased so enormously during the past few years, that Messrs. Schimmel & Co., of Leipzig, have found it necessary to undertake a more complete study of the cultivation of the grass and the preparation of the oil in Ceylon, than has hitherto been made. (*Schimmel & Co.'s Semi-Annual Report, October, 1898.*)

The grass is cultivated exclusively in the southern province of Ceylon, mainly between the rivers Ginganga, in the north-west, and Wallaweganga in the east. The present extent of the plantations is from 40,000 to 50,000 acres of land. The grass grows in tufts, to a height of about 40 inches, and only on the declivities of the hills. The plants require but little care; the harvests, however, must be gathered regularly, and in due time, as otherwise the spikes grow too luxuriantly, and partly decay. The crops are generally gathered twice annually, the first during July and August, the second during December and January. The former crop is the more remunerative, as native labour is then more available; it is also more productive, a larger yield of oil per acre of grass being secured. During December and January the rice fields have to be prepared for the south-west monsoon, which occurs during April and May, the result being that the hands are not always available for the citronella crop, and its harvesting has sometimes to be postponed.

The oil is obtained by steam distillation of the grass, without the addition of water, the yield varying from about 22 lb. to 28 lb. per acre for the summer crop, and from 7 lb. to 14 lb. per acre for the winter crop. The produce varies, also, with the age of the grass, the weather, and the local conditions of the various plantations. The yield of oil gradually decreases, and after about fifteen years the vitality of the grass seems to become exhausted and the raising of new plants becomes necessary to maintain the estate in a paying condition.

The distilleries are located at the base of the ridges and hill-sides, where cool water may be obtained in sufficient quantity. The distillate is kept under lock and key, since the natives cannot be entrusted with its care. When a sufficient amount of oil has collected, the proprietor bottles it, and allows the aromatic water to run away. Each distillation occupies

about six hours. The exhausted grass, after drying in the sun, is used exclusively for fuel, as wood is almost entirely absent from the southern province of Ceylon. As soon as the rainy season sets in, the working of the distilleries ceases, owing to the lack of dry fuel. The working expenses are small, as the wear and tear of the distilling apparatus is inconsiderable. The coolies employed receive 37½ cents, the women about 18 cents a day.

Exact figures of the percentage yield of oil are not available, as the weight of grass put into the stills is never ascertained.

The total number of stills in Ceylon is about 600, producing annually about 1,000,000 lb. of oil. The export of oil during 1897 amounted to 1,182,867 lb., while the shipments for the present year, up to August 30, were 1,021,626 lb., as against 781,832 lb. during the same period of last year. Of this quantity, England has imported about 462,000 lb., and the United States 522,000 lb.

The citronella plantations in the Straits Settlements, near Singapore, are insignificant when compared with those of Ceylon. It appears that about 1,000 acres are at present under cultivation there. The oil obtained from that district, however, is of very good quality, and yields as much as 90 per cent. *geraniol*, the average yield being only from 60 to 80 per cent.—(*Imperial Institute Journal*.)

VII.—TIMBER AND PRODUCE TRADE

Churchill and Sim's Circular.

December 2nd, 1898.

EAST INDIAN TEAK.—The deliveries for the eleven months of the current year amount to 16,769 loads against 16,925 loads for that period of 1897. In the November just closed they were 1,197 loads, and in November, 1897, 1,789 loads. The stock here remains about the same as last month, and prices are of course steady in the absence of any possibility of cheaper supplies; but the demand in London has not been very active during the month.

ROSEWOOD.—EAST INDIA.—The demand is good, although not large, and prices are firm.

SATINWOOD.—EAST INDIA.—The chief demand is for finely-figured logs, plain wood being rather neglected.

EBONY.—EAST INDIA.—For prime wood, of good sizes, there is a limited demand.

PRICE CURRENT.

Indian Teak per	load ...	. £ 10-10s.	to £ 32-10
Rosewood	„ ton ...	. £ 9	to £ 10
Satinwood	„ ton ...	. £ 6	to £ 8
Ebony	„ ton ...	. £ 6	to £ 8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST DECEMBER, 1898.

TEAK.—The landings in the London Docks during November were 1,453 loads, as against 1,414 loads for the corresponding month of last year. The deliveries into consumption were 1,172 loads, as compared with 1,756 loads for November, 1897.

The landed stocks analyse as follows:—

8,518	Loads of Logs,	as against 9,581	Loads at the same date last year.
3,731	„ Planks	„ 3,063	„ „ „
20	„ Blocks	„ 15	„ „ „
Total 12,269 Loads		12,659 Loads „ „	

A decided rise in price has lately taken place in both floating cargoes and landed stocks, owing to the increasing rates both in Burmah and Siam, which make it impossible for merchants to replace timber of good quality, except at a very serious advance on the highest figures hitherto paid for this year's shipments.

The abnormal demand for war ships shows no sign of slackening, and this, on the top of the moderate supplies from the forests, seems to preclude all hope of escaping the further rise, of which shippers say the advance just established is but an instalment. Consumption on this side must, however, be the ultimate factor in regulating prices, whatever the cost in India; but it must be admitted that there are no signs of a weaker demand for next year, as, apart from the naval requirements, general business holds good.

MARKET RATES OF PRODUCE.

Tropical Agriculturist, December, 1898.

Cardamoms	per lb.	2s. 9d.	to	3s.
Croton Seeds	„ cwt.	72s. 6d.	to	82s. 6d.
Cutch	„ „	9s. 8d.	to	82s. 6d.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	10s.	(Nominally)	
India rubber, Assam	„ lb.	2s. 9d.	to	3s. 3d.
„ Burma	„ „	2s. 9d.	to	3s.
Myrabolams, Madras	„ cwt.	4s. 6d.	to	6s.
„ Bombay	„ „	5s.	to	5s. 6d.
„ Jubbulpore	„ „	4s. 6d.	to	8s.
„ Calcutta	„ „	8s. 6d.	to	5s. 6d.
Nux Vomica	„ „	8s.	to	10s.
Oil, Lemon Grass	„ lb.	3½ d.		
Sandalwood, Logs	„ ton	£30	to	£50.
„ Chips	„ „	£4	to	£5.
Sapanwood	„ „	£4-10s.	to	£5-15 s.
Seedlac	„ cwt.	60s.	to	68 s.
Tamarind	„ „	4s.	to	6 s.

THE INDIAN FORESTER.

Vol. XXV.]

February, 1899.

[No. 2.

A change of Editors.

In bidding farewell to the readers of the 'Indian Forester,' I am anxious to express to all those who have helped me to keep it going for so long, my best thanks for their assistance. The Editorship of the 'Indian Forester' is no sinecure: there have been times when I have had great difficulty in making up a number and, had it not then been for willing help afforded, especially by the Forest Officers in Dehra, it might have been impossible to keep up the regular monthly sequence. To all these Forest Officers, therefore, at the Forest School and in neighbouring Circles, I wish to tender my very best thanks; and there are others at a distance in India and away in Europe to whom my acknowledgments are also due. It is a pity that the number of contributors is, after all, so small; if only officers, who can do it, would write for the Magazine, it would be possible to increase the amount of original, and decrease the amount of official and extracted matter. I am occasionally told that such and such subjects are too trivial to write about, but this is a mistake; for there is nothing in the daily experience of an officer in one part of India that may not be of interest to his brother officers in other regions.

The 'Indian Forester' was started at the Conference at Allahabad in 1874, at which I was myself present, so that I can claim an uninterrupted connection with the Magazine for 24 years, during 10 years of which period I have acted as Editor. In giving up the Editorship, I give up a work which has interested me much; but I hope still to maintain some sort of connection with it, though I shall be no longer in India.

To our subscribers, too, I wish to express my thanks for their support: of late years their number has largely increased and the finances of the Magazine may be said to be in a flourishing condition. The Receipts, during the last eight years, have usually been a little more than the Expenditure, and if there

were no outstandings, the present balance would be very good. I am satisfied, however, that I leave my successor a substantial sum to carry on with, and I hope that all, subscribers and contributors, will extend the same help to him as they have given to me.

J. S. GAMBLE.

DEHRA DUN

4th February, 1899.

Connection between the roots and leaves of Palms.

I am sending you some samples of Sago Palm (Bot: *Caryota urens*: Telugu, "Bakinimannu," Uriya, "Solopo") collected from the Nallamalai Hills in the Kurnool District, where the species grows in great profusion in damp localities, covering the soil with a regular carpet of seedlings. From these specimens several points may be noticed. First: when one leaf is developed there is one root; when two leaves are developed there are two roots, and generally when three leaves are developed there are three roots, but sometimes more. There seems, therefore, to be a very intimate connection between the number of roots and number of leaves developed; it may be that, where the number of roots exceeds the number of leaves developed, more new leaves are developing. I send also (but regret it has been much damaged) a specimen of grass which has, or has had, 28 leaves developed and has 28 main roots; whether this is merely a coincidence I cannot say.

I send also a portion of a *Caryota* stem, from which I have cut the leaves just above where they separate from the stem. Each leaf completely surrounds the stem at the base of the petiole; in the samples of leaf sheaths herewith sent, I was obliged to cut the net-work of fibres, which was continuous all round the stem for from 2 to 4 feet in length, so as to take the leaf off the stem. One leaf is developed at each node, and between the nodes the petiole of the leaf forms part and parcel of the stem. In the Kistna District I found that 3 leaves were developed at each node in the Palmyra (*Borassus flabelliformis*), and in the date (*Phoenix sylvestris*) even a greater number seem to be produced (I hope to investigate the date more carefully next month).

The stem of the *Caryota*, thus deprived of leaves, resembles a drawn-out telescope, the object glass of which is at the roots, and the eye-piece points upwards.

Referring again to the seedlings, it will be seen that the first root almost resembles the tap root of an exogen, but that the monocotyledonous formation is so distinct. The collum in the dicotyledon is an indefinite point between the cotyledons; in this, what corresponds to the collum (which term, though not Botanically correct in this case, I shall adopt) is a most distinct point. There is not the slightest doubt that at this point, the fibro-vascular expansion from the seed, the root, the first leaf and its sheath diverge. When the second root forms, it develops higher up than this collum point, and immediately below the sheath of the first leaf. The first leaf develops between its sheath, almost surrounded by it, and the fibro-vascular expansion from the seed, and is, therefore, in the middle of the plant. When the second leaf appears, the seed and its expansion have dropped off, and it comes from the base of the petiole of the first leaf, which forms a sheath for the second leaf and between the first leaf and the sheath of the first leaf. It thrusts the first leaf out of the central part and takes the centre of the plant itself. The third leaf acts in the same way to the second leaf, and the fourth to the third leaf, and so on, just as the second did to the first. The third root forms just below the first leaf, the fourth root below the second, and so on, the roots getting gradually higher and higher up above the collum point the later they develop. There seems to be a centrifugal tendency about these roots. This can be further observed from the fact that young palms have none of their roots above ground surface level; but, the older they become, the more such roots above ground appear; and in bamboos sometimes they are seen springing from the lowest two or three nodes above ground level, when the rhizome is fully crowded out. The same is seen in *Caryota* and *Borassus*, but ordinarily the nodes are not so distinct, and they seem to come out between the nodes.

Endogenous growth of wood is generally said to consist of a cellular tissue in the centre with a compact net-work of fibro-vascular bundles outside it, forming a rind. It was generally supposed that these fibro-vascular bundles came from the outside of the rhizome, passed in towards the centre of the stem, and passed outwards again towards the rind and into the leaves. A celebrated botanist (French, I think,) whose name I cannot just now recall, took exception to this, as it was found that tracing some of the fibro-vascular bundles back from the leaf, they passed towards the centre of the stem, then came back to the rind considerably higher up than the rhizome. I think an investigation of these specimens will explain the matter. The fibro-vascular expansion from the seed forms the fibro-vascular bundles of the first root; those of the first root form those of the first leaf and sheath, those of the sheath form those of the second roots and those of the first

leaf form those of the third root; and so the bundles are formed in succession from root to leaf and from leaf to root. In the mean time cellular tissue is being formed in the centre of the plant, kept there and prevented from expanding much outwards by the fibro-vascular tissue. As each leaf develops it takes the centre of the plant, forms a small portion of stem (between the nodes), and is then pushed on one side by the next leaf. As each root develops it takes a position more and more away from the centre, and higher and higher up the stem; but it must be remembered that above ground it cannot come out of the stem, *i. e.*, it must lie dormant until the sheaths of the leaves have fallen away from the stem. As the tree develops the fibro-vascular bundles have to pass from the side of the root (*i. e.* not the centre) to the centre of the stem when the leaf develops at the top and centre of the stem, and is pushed back to the side of the stem by the development of fresh leaves; and the more the stem increases inside, the greater will be the curve of the fibro-vascular bundles, until it is flattened by other bundles coming inside it.

It does not necessarily follow that, because the fibro-vascular bundle has to pass to its root, that it necessarily passes to the bottom of the tree; for the roots appear on the tree higher and higher up the stem, as the tree becomes older; and there must be many dormant roots which have been prevented from coming to the surface by the persistent sheaths of old leaves.

It seems rather curious that weight is attached to the difference in growth between endogenous palms and acrogenous Tree Ferns; for the difference seems merely in degree. Both consist of cellular interior tissue, with fibro-vascular exterior tissue; in the case of palms the fibro-vascular tissue from a leaf appears to descend to form a root before forming another leaf, whilst in the case of tree ferns it appears to ascend direct to form the next leaf. The rind of endogens is consequently far stronger and more continuous. The term acrogenous, too, seems to be misleading, for in the endogenous palms, each leaf comes to the central summit before being pushed aside by a new leaf; the same happens with the Tree ferns.

A. W. LUSHINGTON.

29th January, 1899.

Fire Conservancy.

In his interesting article in the 'Indian Forester,' H. H. invites correspondence on the subject of Fire Conservancy. The reticence of the Department renders the diffusion of

technical knowledge difficult and prevents the 'Indian Forester' from being as absorbing as it might be. This is my reason for hastening to accept the invitation by forwarding a few remarks tending to regulate the correspondence which, it is hoped, may arise.

As usual in Indian forestry the expenditure to be incurred on protection may in the first place be considered. We wish to insure our forests against special danger, the higher the premiums we pay, the fewer the risks we run, but the value of the forest must limit the amount of the yearly premium we are justified in disbursing.

Secondly, as to the method of insurance; we may invest our premium in preventing the outbreak of a fire or in limiting its extent; or we may have both these objects in view. That is, we may devote special attention to the protective staff or to an effective system of fire-lines, or to a combination of both.

But before deciding on the system of working, suitable to a specified area, we have to take into consideration not only the value of that area, but its position and aspect, the climate and local circumstances of isolation, remoteness from populated localities, or the reverse.

The ideas of fixing the width of fire-lines by the height of the grass, or of imagining that lines of any width will, save in the most fortuitous circumstances, arrest the progress of a fire have, I think, been long since abandoned. Lines are now acknowledged to be useful solely as bases from which operations, calculated to limit the extent of a fire, may be undertaken; they serve also to minimize the danger caused by railways and roads open throughout the dry season. This being the case, if we can afford it, it is best to have them clear cut and burnt; but, if our forest is of small value, rough fire-traces must be deemed sufficient for the purpose.

With regard to the width of fire-lines, we cannot provide for exceptional circumstances; on a still spring night we can counter-fire from a 10-foot road; in a breezy summer day our 100-foot line may become an uninterrupted sheet of flame. Here again the value of the forest must be considered. If we are working in coppice or improvement fellings, where a fire may mean the loss of one or several years' income, we are justified in expending large sums in insurance; and when the danger from fire is a constantly recurring one, we are right in exercising extreme caution; thus, where railways pass through valuable forests a 200-foot clearing might not be amiss.

The direction of the fire-lines will indicate the purpose of the designer of the system. If they lie at right angles to the prevailing wind direction, we shall know that the object in view was to arrest the progress of an advancing fire. In

this case they may be half a mile wide and yet fail in their purpose. If, on the contrary, they run with the chief wind direction, we shall know that they were intended as base-lines for limiting the spread of a fire to the area of one forest block by permitting judicious firing along its boundaries, which, in the first instance would not be feasible. Of the system of trained gangs of fire extinguishers, who might be employed in various light sylvicultural duties when not engaged in their professional labors, I have no experience and speak with diffidence. Such a gang would be a valuable acquisition, if fire broke out in its immediate vicinity, but in large divisions the damage would be done before the gang arrived. I would suggest that, to acquire the necessary experience, the men should undergo a course of training in one or two divisions, which offer special facilities, and that, thereafter, the survivors might be made Captains of the various salvage Corps throughout their Province.

Where large areas are under Fire-protection, it is absolutely necessary that the surrounding population should be interested in its success. The Forest officer has many ways of creating this interest. The watchers need not be numerous, but they must not be antagonistic to their surroundings. A watcher, within whose charge one or several unaccountable accidents occur, should be removed; there is probably some friction in his neighbourhood. In the same way subordinates, to whose call for aid the tenantry will not respond, are, in the majority of cases, unfit for their posts. In high timber forests in the hot season fires cannot be controlled by the forest staff, the help of outsiders must be obtained; but it is with suspicion that we note that these outsiders have much experience; it is preferable to find them willing in their ignorance to be led by an experienced forest officer. All watchers, save those immediately concerned, should stand fast when a fire is in progress, for it is the golden opportunity of the spiteful incendiary.

The tendency of these remarks is that, in discussing the points noted on by H. H., it should be clearly set forth what manner of forest we are referring to. Our ideal is an area yielding, say, Rs. 5 per acre per annum, divided into rectilinear blocks by broad lines covered with green sward, with a well-fed watcher in a suitable abode at each angle. At the other end we may have a forest bringing in no income, but costing a good deal for protection, where we must perforce be content with much less effective measures; but there can in no case be any doubting but that judicious outlay reduces our risk.

Remarks on some forest topics in Burma.

The May number of the "Indian Forester" reached me when I was on a forest tour in Germany. The review on the Burma Forest Administration Report in it suggested many thoughts to my mind connected with forestry in Burma, but I was so much engaged at the time in making notes of the various interesting things we saw daily, that I had no time then to set those thoughts down in connected form.

The remarks quoted in the Review by officers on re-production are interesting, though apparently somewhat conflicting. As a matter of fact the re-production question resolves itself into three factors:—(1) a sufficiency of seed-bearers, (2) a due amount of light and (3) a proper condition of the soil. As regards (1), when seed-bearers are deficient, the only means to stock the ground with the desired species is by sowing or planting. As regards (2), we all know that the most important Burma species require a great deal of light for germination and successful growth. As to (3), the chief desideratum is an absence of a matted growth of grass and heavy weed, which is obtainable by keeping the ground well covered with tree-canopy and judiciously letting in light when re-production is required, in sufficient quantity for germination and growth of the young plant, and afterwards a further introduction of light from time to time till the young crop is able to stand by itself and suppress the weed with its own cover.

With reference to the observation, apparently taken from the Tenasserim Report, that teak seed grown in some portions of that part of the province "fails now to germinate, or if germinating, to produce healthy seedlings," there is no doubt that seed introduced from another country often succeeds better than local seed. At the same time it is probable that the failure of the local seed complained of, is attributable to the wrong conditions of light and soil rather than to the quality of the seed. In this connection I remember the very same complaint being made some years ago in regard to the teak seed in the Melghat Reserve, in Berar, yet, anyone now visiting that forest would be surprised at the great mass of young teak in many parts of it, most of which have sprung up in the last 15 or 20 years from local seed, produced by the most unpromising seed-bearers—ancient pollarded trees, full of defects from constant ill-treatment of every sort. The same thing is noticeable in the Ahiri and Bori forests in the Central Provinces, where the seed from old defective trees has produced wonderful results. These results have been brought about by continued protection from fire, grazing and haphazard cutting, which has gradually brought the soil and cover into favourable conditions for germination and growth. These forests were, for the most part, in a very

open state, when first brought under protection. The first consequence of protection was a growth of bushes and hardy species in patches, which suppressed the growth of weed round them, and it was generally around these bushes and on the edges of clumps of trees that the young teak at first succeeded in establishing itself. These islands of tree growth have gradually extended themselves and new islands are continually being formed, so that gradually the ground is becoming stocked, the stock being often principally composed of teak, frequently resulting in too pure a crop, so-much-so as to favour general and oft-recurring attacks from caterpillars. I think these examples of what the seed from old defective teak trees will do, show that it is probably not the seed, which is at fault in Burma. The fault is, in fine, to be found in the absence of one or more of the three factors mentioned above. In some cases it is due to excessive cover, of either tree or bamboo forest, more often the latter. Where it is due to tree-cover, judicious improvement fellings* are required, but, in the case of continuous bamboo cover, the chief means of introducing more useful growth must be by planting, and it is in such forests that taungya plantations are most useful and it is to it that they should be chiefly confined. In other cases, reproduction fails owing to thick weed and matted grass induced by a too open state of the tree-cover. With protection, such open places will gradually fill up, the weed will be killed, and they will in time come into a proper condition to stock with the most useful kinds, either naturally or artificially, as the case may be.

I am glad to see it stated that the great value of taungya plantations is fully recognised and that they are to be continued. I think, however, they should be continued on a well-considered plan, portions of forest to be stocked being scheduled and marked off on the map, so as to prevent the present somewhat haphazard planting, just as it suits the convenience of the taungya men. They should be principally made in bamboo forest and not as a rule in tree forest, unless the more valuable species are deficiently represented. It is deplorable, for instance, to see a fine forest, containing over 50 *Xylia* trees to the acre, destroyed to make a teak and cutch plantation, such as it was my sad fate to see more than once in Burma.

In regard to the planting and weeding of taungyas in Burma, there are a few points which I should like to see altered. The planting is generally at 3 feet apart in lines 12 feet apart with the object of saving the cost of weeding. Now, as a matter of fact, there is absolutely no saving in weeding, as the whole area *must* be weeded, otherwise the enormous growth of grass and bamboo would soon suppress the young plants. It would be unsafe to leave any weed at all between the line. The resulting crop from this manner of spacing does not produce

* Or seed fellings rather. Ed.

nearly as well-formed young trees as those grown at equal distances apart, nor is the ground so soon covered. The young trees cannot develop their branches equally all round the stem; those at right angles to the line are greatly over-developed, whilst those in the direction of the line are quickly suppressed. The lower over-developed side branches do not become suppressed for many years, and when eventually they decay, leave ugly knots and wounds on the trunk which will result in defects in the heart of the future tree. Besides which, instead of a saving in weeding, this unequal spacing really causes an increased cost, for the cover of young plants does not close nearly as soon as with the regular 6 feet by 6 feet planting and therefore weeding has to be continued longer. There is besides an unnatural and premature decay of plants which would, under more favourable circumstances, continue to thrive and do their duty efficiently in covering the ground and suppressing weed. Thus, from all points of view, the regular spacing of 6 feet by 6 feet, is much to be preferred.

The weeding of the taungya plantations is a very important business and requires thoughtful and systematic management. When taungya plantations were first started, weeding was somewhat neglected, consequently some of the older plantations have now a rather patchy crop, but of late as system of weeding in each of the first three years (the first year's being done by the taungya men) and afterwards every other year, has obtained. This system has been pushed to such an excess that two years ago on my tour I found plantations of *15 years old, in which the teak saplings were 20 to 25 feet high, still being clean weeded*. Now it is quite evident that clean weeding carried on to such an age and state of crop are, not only unnecessary, but extremely harmful; for they prevent any formation of an understory of other hard-wooded species, so much needed for the protection of the soil, for which the light cover of teak is wholly insufficient. I am convinced from my observations of 3-year-old taungya plantations in Burma, that a fairly complete stock on ordinary good soil with regular spacing at 6 feet by 6 feet, if well weeded for the first three years, will have sufficiently closed up to dominate the weeds, and that, after that age, it will only be necessary to go through them, cutting down threatening bamboos and white woods every two years till 7 years old, and then again in the 10th and 13th years. In all these partial weedings, every care should be taken to preserve the other hard-wooded species growing *under* the teak, so as to encourage the formation of an understory for the protection of the soil. I know by experience how difficult it is to get workmen to discriminate between what they should cut and what they should leave, but this difficulty should not deter officers from introducing this most necessary reform. I was most pleased to see that, in the

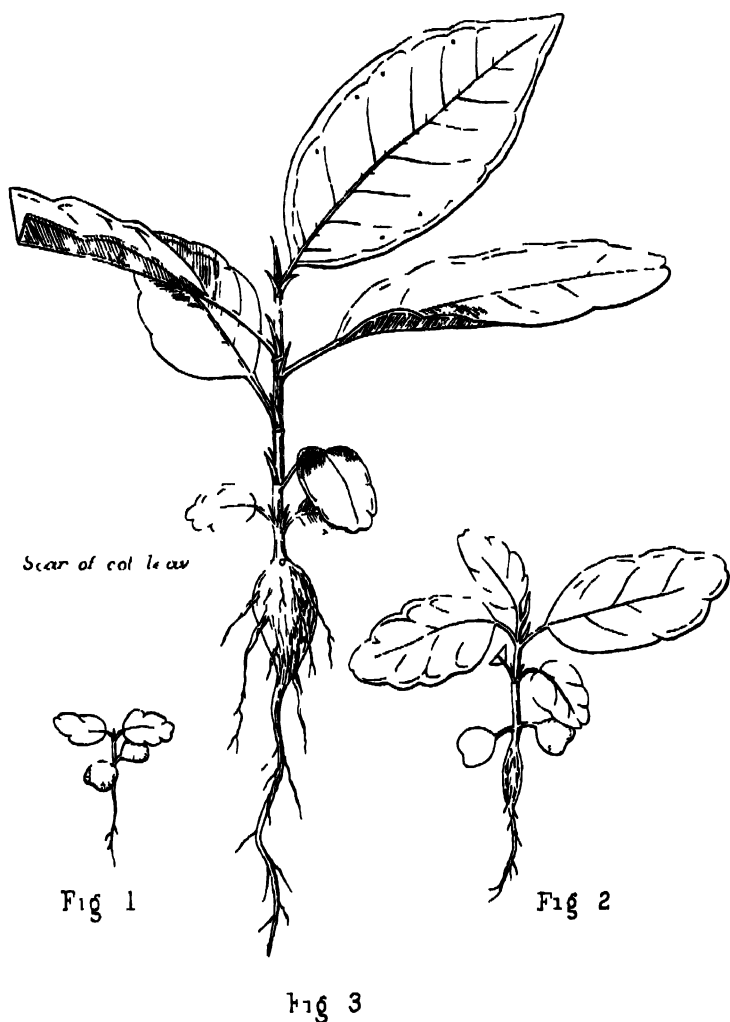
Magayi plantations, a good deal of attention has been paid to this question, and that, in most of the older of them, there is a good deal of under-wood, which materially aids in the protection and improvement of the soil. Of course, it is much easier to attend to such matters in a compact block of plantations like that at Magayi, the care of which was the principal work in his range of the ranger, than it is in a large number of plantations scattered over a wide area, but I have no doubt that the difficulty can be got over by enunciating a well-considered scheme and impressing it on subordinates and workmen on every occasion, punishing the latter when they disobey by refusing to employ them in future or for a time.

In concluding these remarks, I should like to say a few words on the subject of raising teak in bamboo-covered areas. It has been proposed to prepare, immediately before any general flowering of bamboo, by collecting large quantities of teak seed, in order to sow up the flowered areas, but I fear that the chances of any great general success resulting from this proposal are not great. It will be too heavy and expensive a measure to clear and burn the bamboo stems over the immense areas that will be affected. It will, therefore, be only practicable to dibble in the teak seed in the flowering year, or, if possible, in the year previous to flowering and leave the resulting plants very much to themselves, for efficient weeding over such large areas, covered with falling and fallen bamboos, will be also out of the question. Any one, who has had to work or follow game in bamboo-seeded forest, will appreciate the difficulty of getting about in such conditions. Thus, the young teak plants must be left a good deal to themselves to struggle with the dense crop of young bamboo, which will soon appear, and a large proportion of them must succumb. No doubt after a few years we shall be able to go in and save the remnants by freeing them from the surrounding bamboos, but I do not think these will be numerous. At the same time it may be worth while to try the experiment, though I consider it would be unwise to have too sanguine a hope on the result. I think that a steady, well-considered plan of planting up teak taung-yas, dotted about in the midst of bamboo areas, while they are living or dead, will in the long run do more good than general sowings at the flowering epoch. Let us steadily continue to create islands of teak forest in the sea of bamboos, enlarging these as time goes on. It is a work of time, but every such island created is a lasting gain to the forest.

ALASSIO, ITALY :

15th December, 1898.

F. B. DICKINSON.



FICUS ELASTICA, Roxb

- Fig 1* About 10 days after germination
Fig 2 About 1 month after germination
Fig 3 Six weeks after germination
 All natural size

Rearing India-rubber plants in Dehra Dun.

I received about 4 lbs of Assam India-rubber seed from the Director, half of which was sown in nursery beds, which were specially prepared with one part pieces of bricks, one part charcoal and one part dried cowdung well ground, on the 23rd April, 1898. This did not germinate till the end of the first week of June, 1898, i. e., it did not germinate till the rains had commenced, although the nursery beds were well-watered and kept moist. Of the remainder of the seed, $1\frac{1}{2}$ lbs. were sown in nursery beds on the 7th July, 1898. The first lot of the seeds sown germinated well but the seedlings being very small and not able to catch hold of the soil, were washed away when the heavy moonsoon rains came. The second lot of seed began to germinate five days after sowing, but the seed was so light, that much of it was washed away. The remaining $\frac{3}{4}$ lb of the seed was sown on the 7th July, 1898, in 16 boxes and flower pots, and the boxes and flower pots were kept in the potting sheds, where they could get little light, in the School compound and fruit garden. The following was the compost in which the seed was sown in boxes and pots; one part, half-inch or smaller pieces of bricks, one part charcoal, half-inch pieces, and one part leaf mould with a little dried cowdung well ground for top dressing. The seed began to germinate five days after sowing and continued to germinate till the 15th August, 1898.

From the nursery beds I got 108 plants of India-rubber; the remainder of the plants and seeds were destroyed or washed away in the monsoon rains, though carefully protected with thatch. From the 16 boxes and pots I got about 1,600 plants, out of which about one thousand plants have been potted and basketed and about 600 plants, being very small, are still in the boxes.

From the above experiment I conclude, that India-rubber seed requires for its germination that the atmosphere should be well charged with moisture, so that the dry season is unsuitable. The best time, therefore, to sow India-rubber seed at Dehra is during the early part of July; it also germinates in August, but it is almost too late, as the whole of the seed will not be able to germinate before the atmosphere begins to cool, and also the young seedlings have not sufficient time to grow before the cold season begins. The sowing of the India-rubber seed in the open is objectionable, because the rain, either directly or indirectly, when tatties are put over the nursery beds, destroys and washes away the young seedlings and seed. The best way to grow India-rubber seed is to sow the seed in boxes and large flower pots in the compost mentioned above, and place them in potting sheds or verandahs, where they can receive a little light, and never to allow the boxes and pots to get dry. The watering

should be carefully managed, so that the young seedlings are not rooted out and the seed is not washed away.

BIRBAL.

The growth of the seedling. At first a pair of cotyledonary leaves appear, which are about one-tenth inch in diameter, orbicularovate, emarginate, dull green, minutely petioled. Above these come out a pair of opposite leaves. These are stipulate (as are also all succeeding leaves), slightly crenate, distinctly emarginate, membranous, with faint indications of arcuate nerves at the sinuses of an intramarginal vein, very shining above until superseded by the next leaf; one of the two leaves is somewhat larger than the other. Above these the leaves are sub-opposite when they appear, but soon become distinctly alternate by the elongation of the stem, each succeeding one larger in size than the one next below, and much brighter especially when fully grown. The fourth leaf above the cotyledons is about 1 by .6 in., ovate, distinctly crenate, emarginate. The next two leaves, the 5th and 6th, are oblong, 2 to 2.5 in. long, still emarginate, but the crenations are very shallow in the last leaf; lateral nerves 4 to 6 pairs, slightly arcuate. Then comes out the 7th leaf, all by itself, 3 by 1.2 in., oblong, with 6 to 8 pairs of parallel nerves and 2 to 3 intermediate ones between, no longer emarginate, but acute and almost entire, with a row of white glandular dots along the margins. This is the first leaf that reveals the identity of the plant. Beyond this the leaves become thicker and thicker, the 11th being about as thick as a normal India-rubber leaf. By the time the 5th leaf appears, a swelling is noticed below the root-collar, which goes on increasing in size, as is seen in Fig. 3. Neither *F. bengalensis* nor *F. religiosa* seedling has any swelling of this kind.

UPENDRANATH KANJILAL.

II.—CORRESPONDENCE.

Method in Fire conservancy.

DEAR SIR,

With singular pleasure I have read the article on the above subject by H. H. in the November number of the "Indian Forester."

Clearly the only rational plan is, to employ permanent gangs of firemen during the entire dry season. These gangs should in course of time do all the work that has to be done in the cold as well as in the hot season. As a matter of course, they must carry their food and the needful tools with them. They should clear and patrol the fire-lines, and they should be stationed at the points of outlook. The idea of granting special pay after 15th March or 1st April, and of giving

rewards for successful fire-protection in difficult places is excellent. As far as possible the same men should be entertained year after year, so that they may be methodically trained to their work, improvement cutting, thinning, creeper cutting, maintenance of roads, of boundary marks and boundary lines, selection and clearing of fire-lines. And, if during part of the rains, these men could be employed in cultural operations, so much the better.

I fully agree with the writer in what he says regarding *pukka* lines. They must be completely cleared of trees and brush wood, and must be kept clear throughout the season. On such an open line grass is dry and can be burnt a fortnight sooner, than on so-called *kutch*a lines, that is, lines not cleared of tree growth. I am particularly glad to see that the writer fully appreciates this very elementary fact. He evidently has had experience in burning grass lands early in the season, in order to protect the forest tracts; which are surrounded by those grass lands. In January 1879, while on a tour of inspection in the Western Duars, it gave me great satisfaction, with the Conservator's permission, to set fire to a large area of grass land, which burnt splendidly, while the grass in the *sâl* forest, surrounded by these grass lands, was still green and safe. I fully agree with him, in the warning, not to put off burning the grass lands till late.

If I understand the writer correctly, he appreciates the advantage of great care in selecting the outer limits of the area to be protected. He is quite right in preferring, in a hilly country, to have the outer line of the protected area along a ravine rather than along a ridge, for the grass remains longer damp in a ravine, if there is water in it. A ravine that dries up during the hot weather, may often be worse than a ridge. He apparently also knows the great advantage of making use of a broad river. When in 1864 Colonel Pearson, in the teeth of strong opposition from all quarters, determined to make a commencement, he selected the Bori Forest, and the secret of his success consisted in his fixing the outer boundary line of the area to be protected on correct principles. To the North he had the high escarpment of the Sandstone range, which extends Westward from the Pachmarhi plateau. The rain water, which percolates through the fissures of the Sandstone strata, collects at the base and makes its appearance in a line of springs with ever-green shrubs around them. On the North side he thus had a perfect safety belt. And on the West side he selected the Son Budra river, so that he had only to clear 60-feet lines on the South and East. These were proper *pukka* lines, completely cleared, and Colonel Pearson's success in Bori laid the foundation of fire conservancy in India.

H. H. is quite right in laying great stress upon the necessity of keeping an eye upon all stuff that may increase

the violence of the flames, or may otherwise be dangerous. Certainly, girdled trees should not be left standing on or near fire-lines, grass sheds and huts built of wood and leaves, must be burnt early enough in the hot season. Also, what he says regarding the control of traffic on forest roads and the necessity of isolating public roads and camping grounds, is right and to the point.

It has been a special pleasure to read of the Ranger, who was liked and looked up to by the people living near his forests, who could always obtain labour and protect his forest well. It is in fire-protection that a Ranger's real worth can best be seen. He must know his forest intimately, must employ every advantage that may offer, and must guard against unexpected mishaps. His ingenuity, his skill, his energy and his tact in dealing with his subordinates and others, is put to the most searching test during the fire season. If he has succeeded in acquiring influence among the people, it is during the fire season that he will reap the fruits of it. The annual reports of Conservators would be much more interesting, if in the place of dry figures they would, in a few short but effective sentences, indicate, how Ranger so and so had managed to keep out fires from his forest. Works like this should be brought more prominently to the notice of higher authorities, for it shows a man's real value.

Correct views are expressed by the writer regarding the relations of district and forest officers in this matter. The people must realize the fact that there are not two Sirkars but one Sirkar, and that the district officer is behind the forest officer. As H. H. says, the district forest officer must no longer admit theoretically only the advantage of fire conservancy, it is *his* forest and the people must see that he is determined to protect it. This, however, can only be carried out practically by making the district forest officer the Collector's assistant. This, like many other important measures, which I found it my duty to propose during my Indian career, and which I first was able to carry through in the Bombay Presidency in 1870, at that time was an exceedingly sore point with my younger friends and colleagues. Latterly I have been glad to notice a change of opinion, and it was satisfactory to read that H. H. endeavours to warn his colleagues against being too departmental-minded. Where matters are properly organized, the Conservator of course, subject to the control of Government, has the power of the purse and has the chief voice in all personal matters.

It has been a real pleasure to follow the writer in his remarks on this important but most difficult subject, and I may perhaps express the hope that he may follow it up by giving, not an exposition of principles, but an account in detail of how the different ranges in his division

were protected against fire. But H. H. may not be a divisional officer, he may by this time be a Conservator, unless indeed, H. H. should have been chosen as the abbreviation of His Honor the Lieutenant-Governor, which, though it would be charming, is not very likely to be the case. Whether Conservator or Divisional Officer, the next time he writes upon the subject, he will, no doubt, be able to give a most interesting and instructive account of the clever dodges employed by him and by the officers under his orders in protecting his forests against fire, and he will perhaps even favor us with the names of the divisions and ranges to which his paper relates. In his present paper, H. H. speaks of several Circles in which he has served, and of several Divisions which he has held, but he leaves the reader to guess which Circles and which Divisions he refers to. Had I known which localities he was writing about, I should in some respects have been able to follow him more completely, and should have felt more confident of having correctly understood his meaning.

The writer justly says: As forest conservancy grows in North America, they will probably look to India for guidance in the matter of protection against fire. That time is approaching. In his Report for 1898, to the President of the United States of North America, Mr. James Wilson, the Secretary of Agriculture, states that the canvass of the forest condition of the State of Wisconsin, carried out under his orders by the Division of Forestry, in co-operation with the State geological survey, "has brought out the significant fact, that 'through careless lumbering, followed by destructive fires, over '8 million acres of that State, have been rendered practically 'useless, and one-half of that area a veritable desert, as far as 'present economic conditions are considered.'" And though there may still be in the Senate and in the House of Representatives, a strong party opposed to all really effective action in the direction of forest conservancy, the movement has taken a practical shape in several States. Pennsylvania, New York, Maine and other States have all their Forest Commissioner. In Pennsylvania and New York, State Forest Reserves are being formed on a large scale; the State of New York has established a College of Forestry, which has already been discussed in the pages of the "Indian Forester," and the great and influential American Forestry Association does all it can to promote action in the right direction.

Much more powerful than the action of the Federal or of the different State Governments, will probably be the necessity of the lumber trade and of the paper pulp factories. Millions over millions have been invested in the erection of saw-mills and of wood pulp factories. The forests, which have hitherto furnished the material to feed these costly establishments, and to pay high dividends to shareholders,

are disappearing rapidly, and the proprietors of Stock are beginning to realize the necessity for action in a different direction on a very large scale. A few years hence forest conservancy and fire-protection will be the order of the day, and Indian foresters with real practical experience may look forward to honorable and profitable work in the United States of North America.

DIETRICH BRANDIS.

The Longicorn beetle which attacks Mulberry trees in the Punjab.

SIR,

I was very pleased to see Mr. Rogers' letter on the above subject in the "Indian Forester" for September. Mr. Rogers does not agree with me "that the damage is almost entirely confined to the heart-wood," and I infer from his letter that he would have us believe that the damage done by the insect is mostly in the sap-wood.

I have seen a large number of attacked stems split up, but in almost all cases the main portion of the burrow was entirely in heart-wood. In some cases, it is true, the burrow appears to be between the sap-wood and heart-wood, but these are the exception, and probably accidental. I have seen no burrow of any length in sap-wood alone, except in the small branch-wood where there is little or no heart-wood. At certain intervals down the stem, the larva turns outwards and makes a hole communicating with the outside, presumably for the purpose of aeration, and naturally has to pass through sap-wood; but it turns inwards again very soon and continues its course down the heart-wood.

The wounds, which Mr. Rogers has seen on the surface of stems and in the sap-wood, are, in my opinion, after-results, originating with the small holes made at the surface by the larvæ, or with the exit-hole of the mature beetle, and becoming converted into wounds, often of large size owing to decay, accelerated, if not caused, by the entrance of rain water. This view is supported by the fact that these wounds are only seen on the older stems, from which the mature beetles have already emerged, and in no case have I ever seen these wounds on stems in which there is a living larva, which would tend to prove that they are after-results and not caused directly by the insect.

Had Mr. Rogers seen a number of stems split open, and traced the burrows to their full extent, I think he would have agreed with me that the burrows are mostly confined to the heart-wood.

I do not agree with Mr. Rogers' idea that the development by the Mulberry, of a mass of small branches, is the result of the damage done by the insect in destroying the sap-wood. The same development of small branches is seen on sound stems and it is simply a peculiarity of the Mulberry tree. This development of a mass of small branches is still more noticeable at Ohanga Manga, where this insect does not yet exist.

The only practical remedy against the insect is to cut out all attacked stems and collect and destroy the larvæ. The damage chiefly originates in the young compartments, and the removal of attacked stems would be of the nature of a light thinning, which would probably be beneficial rather than detrimental to the growing stock.

As a rule, one can tell whether the mature beetle has emerged, by the presence of the large round exit-hole, and also by the coarse fibrous wood refuse, instead of the finer wood-dust made by the larvæ.

It is not yet known how long the larval state lasts. Considerable search was made this year, in July and August, for the mature beetle, but only one specimen was found. This resembles in form those found last year, but differs in colouration. The colour is a dirty yellow, but the elytra have several white blotches on them and there are two bright orange spots on the thorax. It differs also on the under-surface in having a broad white marginal band round the abdomen extending to the head, whereas the under surface of the previous specimens is a uniform brownish yellow.

B. O. C.

12th November, 1898.

Wanted—Jerry mangalums.

SIR,

Would you mind getting a lot of the above, or at any rate, being accessory to the fact? Madras men will know what is meant, but for the benefit of others who do not know Madrassee, it may be as well to explain. The jerry-mangalum is a beast, I say it advisedly, and distinctly, though all naturalists of any standing call it a spider. There are two cousins in the family, and both are wanted; one is called Mygale, the other Galeodes. Europeans sometimes call them indiscriminately 'tarantula.' They may be dug out of holes

in the ground, are found under bark sometimes, are often seen running about the walls of houses or tents, and may be more seldom caught by mere agility, in running. I knew a man who once caught one, only he didn't. He took off his shoes and gave chase to one, but had the mishap to put his foot on a scorpion. Neither the scorpion nor the man remembered that meeting with pleasure, and the jerry-mangalum was not asked what he thought of it. The mouth of *Galeodes* consists of two large pairs of lobster claws, side by side. Whether it is more correct to say they bite or they sting, is a point that may be argued later. In the meantime the Honorary Secretary of the Bombay Natural History Society, would no doubt be glad to receive as many as he can get. Mr. Pocock, of the British Museum, is studying them. and there are probably many new species to be found.

F. G.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Notes on the Experimental Tapping of Rubber-trees in the Charduar Plantation, Assam.

Experiments in tapping 21 selected trees in compartments 2 and 3 of the Charduar rubber plantation during the years 1896-97, and 1897-98 the results of which are shown in detail in Appendix VI of the Assam Forest Report for 1897-98, gave a yield of 23 seers in 1896-97, and of 24 seers in 1897-98. The trees experimented on have been lightly tapped, and show no signs whatever of having suffered in any way; there appears to me, therefore, to be no reason to suppose that other trees in the plantation of similar age, the oldest experimented on being over 20 years and the youngest 17 years, would be damaged if subjected to similar light tapplings.

The compartments that contain trees not less than 17 years of age, that is, in which vacancies were finally filled up over 17 years ago, are Nos. 1, 2, 3 and 4. These compartments cover 318 acres, and contain 5,221 trees, as ascertained by actual counting; of these, alternate trees (say, 2,600) were over-tapped for three successive years in 1889, 1890, and 1891, with a view to killing them out, as the trees had been planted too close together to admit of proper development of their crowns, on which the full growth of a tree depends. It was found, however, that no amount of tapping affected the continued growth of the tree, and the opening out of the roots showed that all the

trees in these compartments had become fairly anastomosed, or, in other words, that the plantation had become practically one huge tree.

The question now for consideration is whether the systematic light tapping of all the trees in the compartments Nos. 1, 2, 3, and 4 should be carried out every year, under the personal supervision of the Divisional Forest Officer and his Divisional Forest staff as an experiment, and with the view to Government's obtaining some present return for the expenditure incurred in forming the plantation. This expenditure from 1873-74, when work on the plantation commenced, up to 30th June 1898, amounts to Rs. 1,67,627, or Rs. 75-8 per acre for the 2,218 acres that had been planted up to that date, including 518 acres that were disforested in 1896-97 for tea cultivation.

The present value, taking it to be the cost debitable to the existing plantation, may be accepted as:—

	Rs.	Rs.
Total cost incurred up to 30th June 1898	1,67,627
<i>Deduct—</i>		
Value to be recovered for rubber-trees on 518 acres disforested, fixed by the Government of India at Rs. 89 per acre on 482-87 acres actually established	18,832
Expenditure that may be written off as incurred on the experimental stage, i. e., on learning how to plant rubber successfully, taken to be cost up to 1880-81 and partly up to 1882-83, up to which years almost all previous plants had to be replaced	34,000
Sales of rubber, seed, and seedlings, 1897-98	1,050
		<hr/> 53,882
Balance	<hr/> 1,13,745

which on 1,700 acres of plantation existing on 30th June 1898, equals Rs. 67 per acre. With the experience gained, it is estimated that future extensions will cost a maximum of Rs. 40 per acre.

Tapping lightly all the trees in compartments Nos. 1 to 4, including the 2,600 that it was attempted to kill out and the 21 that have been experimentally tapped during each of the last two years, may, it is expected at a low estimate, give the following results:—

	Mds.	Srs.
Two thousand and six hundred untapped trees may be expected to yield annually an average of 1 seer per tree	65 0
Two thousand six hundred and twenty-one tapped trees at $\frac{1}{2}$ seer per tree	32 30
Total	...	<hr/> 97 30

72 **EXPERIMENTAL TAPPING OF RUBBER-TREES IN ASSAM.**

say, 8,000 lbs., the cost of collecting which will be 8 annas per lb., or Rs. 4,000.

The value in London of the samples sent from the plantation tappings in 1896-97, through the Reporter on Economic Products to the Government of India, was 2s. 8d. per lb. The report on the value of samples (24 seers) sent to that officer, the result of tappings in 1897-98, has not yet been received.

Mr. W. H. B. Lawes, Superintendent, Bashwanta Tea Company, has kindly placed the following information at my disposal regarding the result of tappings of 121 rubber trees that were planted about the coolie lines of Dikorai garden, some 17 to 20 years ago, and have not been looked after, having been cut about from time to time by the coolies. These trees were lightly tapped by tappers supplied by the Deputy Conservator of Forests, Darrang Division, and rubber was shipped to London early in 1898.

Rubber obtained by tapping	...	...	...	lbs.
Rubber sold in London	...	...	...	180
				170
Consigned in London to Messrs. George Williamson and Company; realised in London on 170 lbs. at 3s. 3d. per lb.				Ra. As.
£ 27-12-6 (say)	...	...	415 8	
<i>Deduct</i> —			Ra. As.	
Cost of tapping	...	...	90 0	
Freight to Calcutta, Re. 1 per maund (say)			2 8	
Freight, Calcutta to London, and other charges, £ 2-2-6 (say) 3 annas per lb. on 180 lbs.	...	...	82 0	
			<hr/>	124 8
				<hr/>
		Profit	...	291 0

or Rs. 2-6-0 per tree.

From the above data and statistics it may be assumed that, taking the sale value of the rubber in London at 2s. 8d. per lb. as reported by the Reporter on Economic Products, the financial results of the annual experimental tappings proposed may be safely estimated as follows:

Sale value of 8,000 lbs. rubber in London at 2s. 8d. per lb., at 1s. 4d. per rupee	...	...	Ra.
			16,000
<i>Deduct</i> :—			
Cost of tapping 8,000 lbs. at 8 annas per lb.			Ra.
Freight to Calcutta at Re. 1 per maund, say			4,000
Do. Calcutta to London, and other charges at 3 annas per lb.	...	...	98
			1,500
			<hr/>
			5,598
			<hr/>
		Profit	...
			10,402

which equals about Rs. 2 per tree, or on 818 acres, Rs. 82-11-4 per acre, and on cost per acre over nearly 50 per cent.

I have been somewhat diffident at putting forward proposals for systematic tapping for fear of eventual evil results on the capital value of the plantation as a property in which a considerable amount of Government money has been expended. I think, however, that, *given proper personal supervision by the Divisional Forest Officer and his staff*, the time has come when at least the experiment should be tried on the most mature area of 818 acres out of the 1,700 acres that have been planted up, and I therefore advocate, after having visited the plantation again, that action should be taken in this direction during the present tapping season.

DATED CAMP TREPUR,
The 10th November, 1898.

A. L. HOME,
Conservator of Forests, Assam.

Paris Exhibition.

A Circular of the Government of India has recently been issued, in which the following are noted as the articles to be sent by the Indian Forest Department.

Raw products.

- (1) Timber logs, sandal-wood, bamboos, etc.
- (2) Minor forest products.

Manufactures.

- (1) Of wood.
- (2) Minor forest produce, tannin extracts, cutch, dyeing substance, fibres, drugs, etc.

Implements.

Models of timber slides, elephant gear, axes, dahs, etc.

Miscellaneous.

- (1) Dresses of jungle tribes, models of their houses, etc.
- (2) Photographs illustrating forest subjects.

Study of Forestry in connection with Field Crops.

The following recommendation by Dr. W. Schlich, O.I.E., Principal Professor of Forestry at Cooper's Hill, has just been circulated by the Government of India.

"The students met me at Salzmünster on the 20th June, where we examined the natural regeneration of oak, accompanied by beech, and the conversion of oak coppice woods into high forest. We then spent a week in the Spessart to study

'more closely the artificial regeneration of oak. Our next move was to Viernheim in Hesse-Darmstadt, where we saw the regeneration of oak and Scotch pine in combination with the rearing of field crops, which has been carried on in these forests during the last 80 years with remarkable success. A visit to these woods is of special interest to those who are about to go to Burma, where a similar system, the so-called *toungya* teak cultivation, is carried on. Those Burma Forest Officers who have lately attacked the *toungya* teak cultivation, would do well to pay a visit to Viernheim during their next furlough, when they would learn something."

IV.—REVIEWS, &C.

The Kashmir Forest Report for 1897-98.

This Report for the Hindi year, 1954 (1897-98), shows great additional strides in the progress of organization of forest work in Kashmir, which we have followed regularly in the 'Indian Forester'.

The following extract gives Mr. McDonell's summary of the year which will be read with interest.

"The year was a very prosperous one in every way for the Forest Department of the State, not only did the revenue exceed that of the past year, but good progress was made in demarcation, and there was little or no opposition on the part of villagers and others, such as has been experienced in the past. It is believed that the people are beginning to see that the Department tries to be a friend and not an enemy, and as one or two examples were made of dishonest and tyrannical foresters and guards, both the villagers and officials are learning that the control is fairly effective and far-reaching.

"Sales of timber were good on both the Chanáb and Jhelum rivers, but the greater part of the revenue came, as in the past year, from the sale of broad-gauge sleepers to the North-Western Railway, a very large number having arrived and been sold. There were also enhanced receipts under many small heads of revenue, all of which helped to swell the total obtained."

The area of forest in Kashmir is gradually being brought under schedule, and we gather from the returns that it amounts at present to the following acres :

Division.		Forests completely demarcated.	Forests of which the lower boundary is demarcated.	Undemarcated Forests.
		Acres.	Acres.	Acres.
Kamraj	...	96,780	74,842	72,815
Kashmir	...	111,001	151,833	32,576
Mosufferabad	..	48,705	48,156	27,180
Bhimbar	...	15,621	10,316	90,830
Jasrota	...	1,852	..	68,953
Udhampur	...	62,448	43,722	74,874
Jammu	...	27,203	22,312	129,344
Total	...	36,3560	351,181	491,602

Grand Total 1,206,343 = 1,885 sq. miles.

The difficulty about 'jagirs' is clearly described as follows:

"Many instances could be quoted in which the State 'has lost its title to culturable land; there are a number of 'small jagirdars in the State, and it is probably not too 'much to say that every one of them holds at least double 'what was originally granted to him. Whenever forest ad- 'joins these jagirs, the Forest Department has stepped in 'and prevented any further encroachments by putting up 'pillars, but there is still a large area of waste land unde- 'marcated, which will assuredly be absorbed by jagirdars, 'unless some steps are taken to declare that any new land 'broken up for cultivation shall be measured and assessed as 'State property. It is much to be regretted that when jagirs 'are granted, boundries are not at once laid down and mapped 'so as to prevent encroachments on the State property; nor can 'much blame be imputed to the jagirdars in such cases, it is 'manifestly the duty of the State to protect its own interest, 'and, if it fails to do so, it cannot be wondered at that loss 'should result. As was once before pointed out, herein lies 'the secret of much of the opposition to the demarcation 'carried out by the Forest Department. These jagirdars see 'that, once the fatal obstacle of a demarcated boundary line 'appears, there is an end to the extension of their lands."

The extract shows clearly how very important it is that demarcation should be speedily and definitely completed every-where,

Working Plans work has been started in a preliminary manner as is recorded in the following extract, which is interesting as giving an idea of the stock in a Kashmir deodar forest.

Kamráj.—"A rough Working Plan with a complete enumeration was made for the Chandigam block in the Loláb valley. This block forms part of a dense deodar forest, situated on both sides of a spur, running due north, and rising from an elevation of about 5 500 feet to 7,000 feet. This spur, which is an off-shoot of a higher range of mountains, also covered with deodar and other forest has been treated separately, because it practically forms a separate compact forest more conveniently worked by itself. The total area of the spur is 1,267 acres, of which the Chandigam block contains 511 acres and the other, called Dorus Wán, 756 acres. These two blocks will eventually come under one Working Plan treated on a rotation* of 30 years. The Chandigam block has been cut up into 15 compartments, i.e., half the rotation; the compartments have been marked with numbers, and wherever necessary, a ten feet wide line has been clear cut to mark the boundaries. The forest is not pure deodar, the proportion being 7 deodars to 1 blue pine; it is situated above a swamp, which contains sufficient water to be utilized as means of export, as far as the Pohru river, which, after traversing the Loláb Valley joins the Jhelum river near Sopor. The stock has been damaged by fires which were of frequent occurrence before the forests were taken up. At the present time snow and storms do a certain amount of damage every year. From the following statement of the enumeration survey it will be seen that all classes are well represented except the 12 to 18 inches diameter classes. These classes are in the minority because they were used for house building before the Forest Department was constituted as at present:—

Sound trees—Diameter classes.

6"	12"	18"	24"	Upwards.
Not counted.	4,340	5,779	8,122	7,077

Number of first class trees per acre 13.8.

Unsound trees, branches or leaders.

6"	12"	18"	24"	Upwards.
189	608	635	706	612

* Felling rotation : Ed.

The above are such as have been given off by 985 unsound trees. The enumeration does not contain dead trees, which, together with the fallen trees, will be worked out first. To maintain an equal annual yield throughout, the number to be felled yearly will be fixed when the enumeration of Dorus Wán has been completed; it will probably be 400 trees per annum to be felled under the selection method, subject to certain conditions laid down for the general improvement of the forest."

The number of cases brought before the Courts was 212, and 370 cases were compounded. There are still many cases which, apparently, have been dragging on for a long series of years, and no less than 434 of these were pending at the close of the year.

Fire-protection was fairly successful, and, as might have been expected, most of the cases were of grass lands with a few *P. longifolia* trees. The number of fires was 82 and the area burnt 11,054 acres, scarcely any of which was fortunately in deodar forest.

The chapter on "Natural Reproduction" has much to say on the important question of the struggle between the blue pine and the deodar. We proceed to quote the portions of chief interest.

"There was a very fair supply of deodar seed in Kamraj, though the year was not what might be termed a full seed year. This will probably come next year, i. e., the fourth since the heavy seeding of Sambat 1951 (1894). There can be little doubt that deodar has begun to establish itself in the extensive blue pine forests of the Utr-Mächipura tahsil, and it is quite within the bounds of possibility that many of these will in time be converted into mixed forests of deodar and blue pine. To aid this, many of the latter are given as free grants to villagers, and felled for timber in localities, where young deodar plants are to be found, a process that will tend to help this species to get the upper hand. Luckily, there is little danger to be apprehended from grazing, for cattle-grazing does practically no harm to the young plants, and there being little or nothing for goats and sheep to eat, they do not go much into the deodar forests. The greatest damage is done by Gujars and their buffaloes, and these men will have to be carefully watched; neither they nor the villagers like to see their pet grassy blanks being gradually afforested, and it is extremely likely that they will take to pulling up the seedlings if these appear in any numbers in the grass. The natural reproduction in this (Kamraj) district is, on the whole, excellent. Most of the forests contain very good patches of seedlings and young plants of all ages which are fairly well scattered about. There appears to be few seedlings from last year's seed, owing, perhaps, to a poor crop, but

'here and there, as in the Kumbriál forest, small patches 'containing 20 to 40 seedlings of the year have been observed. In these forests a great many seedlings die down at 'the first frost, the reason probably being that there is a thick 'layer of leaf mould on the surface, through which the tender 'roots cannot penetrate. In many places, notably in the Pánjal 'forest near Bárámula, there are dense patches of seedlings 'where thinning is required, which operation will give more 'light and room for growth; again, in places there are patches 'of deodar seedlings intermixed with blue pine, but the latter 'is not now needed as a nurse for the deodar, and must be 'gradually cut out or topped, but such delicate operations 'must necessarily wait till the establishment is strengthened 'by the addition of more trained subordinates.

"Some observations have been made in Kamráj with 'reference to the question as to whether the blue pine is 'gaining on the deodar in the matter of natural reproduction. So far as these observations have gone, this would not 'appear to be the case in this part of Kashmir, indeed, in 'several instances that were noted, the deodar was distinctly 'gaining in the struggle. One case was that of a small blank 'in the centre of a forest of nearly pure deodar near Chandigam, here, although there were no less than four seed-bearers of 'blue pine on the edge of the blank, still the proportion of young 'deodar to blue pine was as ten to one. In another instance 'in the Kumbriál forest, of which the composition is mixed 'deodar and blue pine, it was observed in a fairly large 'area where the seed-bearers of the latter were in excess, the 'proportion of young deodar was much larger than that of 'blue pine. In another place, in the Krumpura forest, an 'excellent plot of young deodars of all ages, from small seedlings to poles, was particularly noticed. Here there are seed-bearers, both of deodar and blue pine, fairly evenly represented, yet while literally hundreds of young deodars are 'to be seen, there is only one solitary sapling of pine. A 'few paces from this patch, is another of young plants of 'deodar under three feet in height, in number perhaps over 'one hundred, yet though there are seed-bearing pines near 'the spot, there is not one plant of this species to be found at 'this particular place.

"In the Uri tahsil in Muzufferabad the seeding of deodar 'and other conifers was fairly good this year. Uri may be said 'to form the dividing zone between the comparatively dry and 'moist climates, and the composition of the forests is somewhat 'peculiar: thus the *chil* (*P. longifolia*) and grey oak (*Q. incana*) 'extend up the Valley as far as Uri village, and above this 'their places are taken by deodar, ash, &c. *Q. dilatata* is sparingly found up to Rámpur, 14 miles further up the Valley; 'above this, and in all the Kashmir Valley proper, there are

'no oaks, nor is the *P. longifolia* found, though the elevation is under 5,500 ft. It has been observed that the lower slopes below Uri village are generally bare to some extent, and more especially those which have southerly and westerly aspects. In the higher localities in the moist region below Uri, where the rainfall is greater and where heavier mists hang over the forests during the rainy season, blue pine and firs abound, but in such localities the deodar is absent. On the other hand, the lower slopes on the right bank of the river above Uri, which are situated in a drier climate and are exposed to the south, are generally covered almost exclusively with deodar; those, however, just opposite on the left bank, and having a northern aspect, and consequently much cooler, are densely clad with both the cedar and the blue pine, the latter in some cases descending as low as the river bank. From these and other observations it would appear that deodar prefers a drier climate, and is more hardy than the blue pine. Certainly, it has been noticed often, that reproduction of deodar is much better in exposed localities than in the shady recesses of a forest. Blue pine, in a comparatively moister climate, will often grow to the entire exclusion of deodar."

The following figures give the outturn of timber for the forests during the year.

		Cubic feet.
By State agency	...	2,783,292
By purchasers	...	1,801,833
At privileged rates	...	100,950
By free grants	...	23,124,145
Total		27,310,220

The huge amount given in free-grants is very note-worthy.

The number of sleepers brought down and sold was:—

		Rate
Chenab	... 62,148	2-12-6
Jhelam	... 162,839	3 - 1-0

which gives very nearly an average of Rs. 3 per sleeper all round.

The financial results of the year were as follows:—

		Rs.
Revenue	...	10,96,548
Expenditure	...	4,01,224
Surplus	...	6,95,324

which is nearly 8 lakhs of rupees more than the average surplus of the last six years. With such a balance sheet, the Kashmir durbar ought to be amply satisfied with the results of forest conservancy.

We will conclude with the following interesting extract on the subject of the effects of lightning. Unfortunately, we are not told whether fire was communicated to the surrounding forest, as was found to have so many times happened last year in the forests of the School Circle, N.-W. Provinces.

"A curious and noticeable fact in the *chil* forests of the Bhimbar district is the number of trees that have been struck by lightning; such are found, not only singly, but in groups. As many as eight trees have been counted in the centre of a forest in one spot, from which it might be imagined that there is some attractive substance, such as iron, in the soil or underlying the soil at certain places. This is not, however, the only remarkable fact, for the lightning when it strikes the top of a tree, instead of rushing down, as is ordinarily the case, breaking everything in its passage to the ground, runs down straight for a few feet, then striking a branch, is diverted, and, in most cases, makes a spiral of four or five turns before it enters the ground. The lightning in its course removes a strip of bark varying from 2 to 4 inches wide, and does not leave any signs of burning, so that an inexperienced eye would mistake the mark for one made by the constriction of a creeper which had fallen off or been removed from the tree."

VI.—EXTRACTS, NOTES AND QUERIES

Forests and Water-supply.

Both in Europe and in America this question is receiving much attention, and as facts are of more importance than many theories, no excuse is needed for reverting to the subject in order that a knowledge of these facts may be as widely spread as possible. The *Revue des Eaux et Forêts* has two more articles on the subject; one from the pen of M. A. Mathey, the other from that of M. Ch. Broilliard, the valued friend and teacher of many Indian foresters. M. Mathey treats of Switzerland, and especially of Berne. Since 1868, this city has established water-works in five or six valleys containing springs with a more or less fluctuating flow, as follows, on the average of about 10 years:—

	Smallest mean flow. Litres per minute.	Date.	Greatest mean flow. Litres per minute	Date.	Annual variation.
Gasel	1,011	13 Jan.	4,154	Feb.	1 : 4
Schlieren	290	13 Ap.	784	Sep.	1 : 2.7
Scherlinthal	2,222	30 Sep.	1,5000	Sep.	1 : 6.7
Fier Moulin	882	14 Ap.	1539	Nov.	1 : 1.7
Brünback	1,765	11 Mar.	4,390	Oct.	1 : 2.5
Steinenbrüner					Small.

It will be seen that some of these springs vary in their yield more than others, and also, that the smallest yield occurs at different periods. For a town-supply, it is important that there should be little variation and that the time of minimum yield should be deferred as long as possible towards the next rainy season.

The Fier Moulin and Brünback springs are favourably situated, in that the greater proximity of high mountains causes the snow to lie longer and the rain to come sooner, but they are also protected by dense forest. Gasel and Schlieren being exposed to the South, have both been planted up and are well protected by forest, but Scherli is more open, having only one bit of forest high up. Its variation is greatest. The rains of the autumn of 1892 (1893 ?) caused the Scherli springs to flow at once, while Gasel showed little effect till January 1894, and Schlieren till April 1895. After the great drought of 1893, the Scherli springs, being unsheltered, reached their lowest level by September 30th, 1893, while the minimum flow was delayed at Gasel for $8\frac{1}{2}$ months and at Schlieren for $6\frac{1}{2}$ months. It is thus highly desirable that the Scherli basin should be planted up as soon as possible. M. Mathey relates, by way of a moral, an incident in which he took a leading part. In the Commune of Flacey (Cote d'or) is a small plantation. The Mayor was grumbling at the rate of growth and the small revenue, and even talked of cutting down the whole. The village brook was just below, and in flood, as it had been raining. A week previous it had run nearly dry. This was pointed out to him and he was presented with the suggestion that, so far from cutting down, he ought to plant up 200 acres in Wezy, dry Kimmeridge limestone, producing a rental of barely 2 shillings an acre. It then came out that at the beginning of the century this barren land had carried an excellent oak coppice, and that the full and regular supply in the brook was still held in remembrance. The planting of Wezy has actually begun, and the people of Flacey will long have cause to thank their Mayor and M. Mathey.

M. Broilliard takes us first to Russia and asks a question as pertinent here in India as there. The Russians have ascertained that in regions of very small rainfall (*e. g.* Deccan) forests lower, and lower considerably under some conditions not too clearly defined, the level of sub-soil water. Will they, the Russia

(or Indian non-forest officials), at once hasten to use the fact as an argument against having any forests there? Whatever may happen, or has happened here, the Russians will take good care to be led astray by no such error. They can see their vast rivers dwindling and silting up before their eyes. Our Deccan streams are already dry, and responsible officers calm their consciences by saying that it always was so, and must be so. But they do not know that it always was so, nor will any forest officer believe it.

The Chief Fire Warden of Minnesota, Mr. C. C. Andrews, has just published his annual report under the title "Forest, maintains water-supply," and his title is based, not on ideas but on solid facts. America is a young country, but its officials have no native press to be afraid of, and can look facts in the face. Fifty years ago the American naturalist, Henry D. Thoreau, wrote "The Maine Woods," in which he stated "the primeval forest is always and everywhere moist and mossy," and again, "the surface of the soil in the Maine woods is everywhere spongy and full of moisture." George P. Marsh, another reliable witness, wrote to the same effect. William Cullen Bryant also; "fifty years ago, large boats, heavy laden with merchandise, plied up and down the Cayahoga river; now, a small boat or skiff is all that can pass, even in the lower reaches," (the American work not being available, the quotations are translated from the French, and will, therefore, not be the *ipsissima verba*). Both, Minnesota and the York States are feeling the diminution of water-supply. In 1884, New York nominated a commission of enquiry under Professor Charles S. Sargent to report on the condition of the Adirondacks. This mountainous plateau feeds several great rivers like the Hudson and Mohawk, and many small ones. The report stated that the influence of the forests was felt far beyond the limits of the State, and that their destruction would be followed by far-reaching commercial disaster. "The future of the rivers rising in the Adirondacks can be deduced from their past. Great changes have been observed since the forest area has been lessened. All the evidence obtained by the Commissioners goes to show that the summer yield of these rivers has diminished within the memory of man by from 30 to 50 per cent. Many little streams, which, 25 years ago had an abundant summer flow, are now dry for some months of the year. The flow is becoming more uncertain and irregular every year, and the losses by spring floods and summer drought go on increasing. All this is due to the destruction of forests, and the evil will increase if matters go on as at present. On the tributaries and head-waters of the Mississippi, the Sainte Croix, and the Red River, lumbering has been practised for the last fifty years, and in consequence of the destruction, the volume of water has diminished." Mauritius and Réunion are

arid spots in the midst of water, but only since their forests were destroyed. In St. Helena an important spring had dried up, but was restored by planting. Laboratory experiments are difficult to devise and of doubtful value, since they cannot be carried out under true conditions. Marshal Vaillant cut off a branch and placed the cut end in water. The evaporation from the leaves was prodigious, far more than the whole rainfall. The conclusion to be drawn is—*Nil*. A cut branch is not a growing tree, and a growing tree in some conditions is not like a growing tree in other conditions. The quantity evaporated is influenced especially by the quantity available. When the supply is small, the trees manage to get on with little. The pine, if water is plentiful, evaporates immense quantities, but it can also live on soils where there is almost none, *vide* the Southern and Western aspects of the Alps in the valley of the Durance. Even the spruce, which will grow in a marsh, nevertheless flourishes on the dry limestones of the Jura. The Eucalyptus has done good service in drying up swamps, but in Australia it frequently grows in places subject to terrible drought.

A good European case is that of the forest of Hardt, 85,000 acres, on Rhine alluvial deposits to the South-west of Mulhouse. The sub-soil is a great depth of coarse gravel and pebbles without capillarity, and the sub-soil water is down at Rhine level, some 45 ft. below the surface. A branch of the Rhine and Rhone canal passes through the forest, without a lock, for 12 miles. One fine day the bank burst and the forest was completely flooded. Within three days all the water disappeared, having sunk in at once to the 45 feet level. There is here no protecting canopy of high forest, only a coppice with standards consisting of oak, hornbeam, &c., on a shallow limestone soil with the great depth of pebbles below. The aspens die out at 20 years old, and the oak standards often die also when isolated, but the coppice, exploited at 30 years, is fairly productive. Now, here is a forest which certainly does not pump up water from 46 feet below. What can it evaporate? Certainly less than the annual rainfall, for much or most of this sinks in at once, yet the coppice remains complete. It is probable that after the abundant spring sap has fully formed the new leaf, the evaporation becomes quite small. If a branch is cut in the spring the section will wet the fingers, but if cut in summer it is barely moist. In the spring drought of 1893 the leaves withered on the trees, while in the summer drought just past, they remained perfectly green. Plants in pots give widely differing results; one experimenter even found that such plants evaporated a solid yard deep of water within the year. Mr. Samuel B. Green, Professor of Horticulture and Forestry at the Minnesota University, found that forest trees, evaporating less than agricultural crops, evaporate per acre from 500,000 to 1,500,000 pounds of water during the

season of growth, or a layer of 6 to 17 centimetres deep, say $2\frac{1}{2}$ to 7 inches. Ebermayer, a most competent observer, found that sandy soils allow to filter through them more water than falls on the surface. This appears an inconceivable marvel, but it may be accounted for on the supposition that the soil condenses moisture from the air. But whence does the air obtain it in a dry summer? Evidently from the leaves. Hence the same water serves over and over again. Here is food for reflection. A forest has mould, and thereby substitutes a sponge for a mere sand filter. Consequently, in regions of small rainfall, a forest is even more useful than where rain falls in plenty. The left bank of the Saone between Darney and Monthureux is covered with forest, the right bank is cultivated. Brooks enter the Saone from both sides, but it is not precisely the right bank which provides most of the water. These are all facts outside politics and their consideration may be recommendend to all whom it may concern.

India-rubber from Euphorbia.

The following letter from Major C. Giberne on this subject appeared in the 'Standard' on January 5th last, and is reproduced, as it may be of interest. Perhaps some of our readers may know more about it, and can tell us whether the statements are correct:—

SIR,—With reference to the Leading Article in *The Standard* of to-day on the resources of India, will you allow me to draw attention to the enormous quantity of India-rubber looked up in the jungles of India in the various species of *Euphorbia*, or "milk-bush," with which it is in parts so thickly studded?

Many years ago, when in India, I ordered a box of chemicals from England, and in the course of some experiments I made, I added a little nitric acid to the strong, alkaline, milk-like juice of the *Euphorbia Tirucalli*, and, to my surprise, not only neutralised the alkali, but left floating on its surface, a piece of India-rubber. There is a considerable quantity of the *E. Tirucalli* growing in Guzerat, and especially in the neighbourhood of Cambay, but the supply is limited. On the other hand, there are other species of milk-bush, such as the *E. Antiquorum* and *E. Nerifolia*, the supplies of which, should they be found equally efficacious, are inexhaustible.

I should strongly recommend that a trial be made of all these different species as to the quality of the India-rubber they severally produce. Probably, also, a cheaper acid, such as hydrochloric, would prove as efficacious as nitric acid. The milk could easily and expeditiously be extracted from the milk-bush by

means of a common native sugar-cane press. The only question, then, would be whether the acid should be brought to the milk, or the milk to the acid, and, in the latter case, whether it should be sent in the form of a fluid or be previously dried in the sun and exported to England in the form of the gum known in commerce as Euphorbium?

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

EAST INDIA TEAK.—The importation and deliveries of Timber and Planks have been :—

	1892	1893	1894	1895
Imports	7,923 Loads.	12,687 Loads,	9,849 Loads,	22,200 Loads,
Deliveries	10,455 „	12,646 „	10,620 „	18,399 „
	1896	1897.	1898.	
Imports	23,312 Loads,	20,428 Loads.	18,083 Loads.	
Deliveries	21,941 „	18,410 „	18,526 „	

The record of this branch of the wood trade for 1898 is again that of a thoroughly satisfactory year's trading. The extent of it is not to be gauged by the London figures, the force of London enterprise resulting more than ever in direct shipments from Burmah and Siam to the various centres of demand on the Continent of Europe. The year 1897 had ended well for the Teak trade, with a firm market held steadily to a paying level; the political events of 1898 were destined to justify and accentuate this position. By March this was already becoming evident, and much anxiety was at the same time caused by a most unfavourable floating season in the producing countries, which has eventually proved to have greatly restricted the year's supplies. Prices rose accordingly as each cargo became available for sale through the summer, and in the early autumn the prospect of maintaining prices for anything that could be produced became thoroughly assured. The year closes without any alteration, or prospect of alteration, in this position.

PADOUK.—The import was limited to four small parcels, and stocks are now practically exhausted. Latterly there have been numerous inquiries, and good parcels would sell well, as, although the chief demand is still for export, the home trade has somewhat increased and prices are higher. Quotations are from 8s. to 4s. per foot cube for planks and logs.

ROSEWOOD.—**EAST INDIA.**—There was a good demand, and although the supply was the largest for several years, the parcels were mostly small and were readily taken at full prices. There is no stock, and, as consumption is steadily increasing, shipments of good logs can be recommenced, but they must not be too large, or too rapid, else prices will suffer. Quotations are from £9 to £11 per ton,

SATIN WOOD.—EAST INDIA.—Logs.—There was not much demand for plain wood, and therefore, although imports were very light as compared with the previous year, they were quite sufficient, and these, with the old stocks, only moved off slowly, but there is now not much on hand. Figury logs sold well, and if really fine, brought high prices, as such wood is always saleable. **Boards.**—There were only three small parcels imported last year; two of these were rather poor, but still brought fair prices, the third has only just arrived. There is, however, very little demand for boards. Quotations are from 5d. to 12d. for logs and boards.

EBONY.—EAST INDIA.—The parcel brought forward was sold early in the year at a good price; one small lot (four logs) arrived in April, but there has been no import since, therefore, the stock is exhausted, and small parcels of sizeable, sound, good-coloured logs would find buyers at from £6 to £8 per ton.

Denny, Mott and Dickson's Wood Market Report.

LONDON, 2ND JANUARY, 1899.

TEAK.—An unprecedentedly high rate of shipbuilding, supplemented by great activity in the construction of rolling stock, and a growing taste for this wood in the interior fittings of public buildings and high-class private houses, have resulted in a record consumption of some 82,000 loads, or about 35 per cent. increase on the average consumption for the previous five years. The market has been naturally a very strong one, as, notwithstanding the efforts made in India and Siam to press forward supplies, the imports fell some 4,000 loads short of the demand. The fairly ample stocks on hand in the European depôts at the commencement of 1898, however, prevented any undue straining of prices through the demand exceeding the floating supplies, and the absence of any great variation in the price of the rupee also assisted in keeping prices at a fairly steady level, though they continued to gradually appreciate through the year, which closes with first-class cargoes of good specifications fetching from £13 10s. to £14 per load c. i. f., and cargoes of less reliable quality from £12 10s. to £13, according to specification and reputation of the shipping mark. A good deal of inferior wood found its way to Europe during the year, owing to the high cost of good teak at the shipping ports, but first-class shippers strengthened their reputation by taking what, under the difficult circumstances, must have been exceptional pains to maintain their standard of quality and conversion and reaped the benefit by readily selling all they could send forward, while the "cheap" wood hung on hand, and in many cases must have proved very dear to the consignors.

Consumers doing satisfactory business have not grudged a fair price for good wood, and where quality is no consideration, a cheaper wood than the most inferior teak is preferred.

The New Year opens with good prospects in all the branches of industry where teak finds its outlet, the more especially in the shipbuilding and rolling stock trades, whilst the visible quantity of teak landed in Europe and in vessels on the way, shows some 59,000 loads, or about 20 per cent. decrease as compared with that of last year. Steamship owners, however, are rapidly over-getting their objection to carrying teak, and, consequently, any shortfall in usual sailer shipments, can readily be set right by steam. The one important factor in the supply is the stocks of European quality at the shipping ports. In Siam these will be small, whilst in Burmah they are fully up to last year's supplies, but the outget from the forests during the season just about closing is reported to comprise an unusually large proportion of small trees, so that the supply of European sizes will be difficult to obtain, and, therefore, first-class cargoes must be of a less good specification, unless buyers on this side consent to pay a special price for specially selected specifications.

It is fairly certain that the supplies of good wood from all quarters will scarcely cope with the present rate of consumption, and, therefore, prices should continue to harden during 1899, unless there is a check in the large demand for war-ships both at home and abroad. This naval demand has been the dominant cause of the increased consumption of teak, and notwithstanding the efforts to eliminate inflammable material in the building of war-ships, teak continues to be found indispensable for sheathing, armour backing, and upper decks; even the apparently futile experiments of the United States to use their home-grown woods in contact with armour plates having only served to more fully demonstrate the peculiar fitness of teak as against any other known wood when used in connection with steel work of any kind. So long, therefore, as the demand for navies continues to develop, so long is the rate of consumption of teak likely to continue. The trade expert is perhaps less qualified to judge of the duration of this naval demand than the general political on-looker, but it is difficult to think that 1899 will see a cessation in the present demand from all Governments for new war-ships.

In respect to London's share of the teak business, it is to be noted that, although the important demands of H. M. Admiralty have not been supplied from London stocks, yet the yearly totals have been as follows:—

Imports to Docks during 1898	-18,071 loads,	against 19,878 loads in 1897
Deliveries from Docks during 1898	-18,499	18,112
and 1899 commences with a dock stock of	13,042 loads,	as against
14,587 loads on 1st Jan., 1898		

London has also had a full share of the considerable business done with the Continent in shipments via London, which are rarely lauded here, and are, therefore, not

included in the above figures. The wholesale floating cargo business with the Continent which has been a very full one, is also not touched by the London figures. It must not be forgotten that this very important Continental demand for whole cargoes has added great strength to the general teak market, and although the vessels have proceeded direct to the Continental ports of discharge, their sale has been chiefly effected through London, which port has every reason to continue to be satisfied with its position in the teak trade.

The timber trade has been decidedly prosperous during 1898, the consumption having been a full and steady one, if not so startlingly large as the prosperity of general trade raised an expectation of when the year commenced. There have been, with the exception of spruce deals, no violently disturbing fluctuations in prices, and a good even business has conducted to generally sound finance and the keeping down of bad debts, to the great satisfaction of sound traders. A peculiarly satisfactory feature of the year has been the absence of important strikes, and to this must be attributed much of the prosperity of 1898, and, on a continuance of this happy immunity from labour troubles, is largely grounded the general view that 1899 promises to show even a better trade than that of its three prosperous predecessors.

THE INDIAN FORESTER.

Vol. XXV.]

March, 1899.

[No. 3.

The production of Sandal-wood.

The maintenance of a permanent supply of so valuable a product as Sandal-wood has been fully recognized from the earliest day of Forest Conservancy in India. It would have been strange indeed, if a wood, which sells at an average rate of some Rs. 300 a ton, had not been appreciated at its full commercial value. And yet there are no fixed opinions as to the best means of assuring a sustained yield, and there is a want of a definite policy by which alone the existing resources can be utilized to the best advantage, and a never-failing, possibly a steadily increasing, annual yield can be guaranteed.

The natural habitat of the tree (*Santalum album*) is circumscribed and there is no encouragement to propagate it outside the limits within which it grows naturally. Indeed, it is doubtful whether the wood of trees cultivated elsewhere is sufficiently rich in oil to be of commercial value.

Under these circumstances we can only look to certain districts of Madras, parts of Mysore, and the dry Northern portion of Coorg to supply the demand for Sandal-wood, and it is to the growing of the tree in these parts that our remarks will be directed.

The tree is well known to demand a comparative dryness of climate, where the rainfall is moderate (20-50 inches, *vide* Brandis's Forest Flora, p. 399.) and heavy clouds are not liable to give excessive moisture to the atmosphere, and to grow in poor soils composed of sufficient gravel to make them porous and consequently well drained. It is generally found at an altitude ranging from 2,000 to 3,000 feet. The young plant is extremely delicate and the tree is always shade-enduring. It is especially sensitive to fire, and is too often killed outright by it. Cattle and deer eat it ravenously and destroy large numbers of the young plants, which spring up profusely from seed, which is generally scattered by birds wherever the tree is common.

It is not found in dense forests of good growth, and affects only dry open woods of generally poor growth. It springs up much more commonly in hedge-rows, in clumps of *lantana*, and amongst shrubs, all of which afford it the requisite shelter and protect it from animals. It is rarer inside forests that have been reserved, than in and about cultivation, a fact which is perhaps due to a want of such undergrowth as would protect the plants from deer. It will be seen that the conditions requisite to its growth mark the Sandal tree as perhaps the most delicate of our forest trees, and it is small wonder that plantations of it have not altogether, and sometimes not even partially, succeeded. Still, some success has been attained, and for the future supply of the wood, we may deal with the three following sources.

I.—Trees near cultivation, in hedge-rows, on grazing ground or private lands.

II.—Trees in reserves, grown either naturally or by cultural operations aiding natural reproduction.

III. Trees in regular plantations.

The question arises as to how far and by what means the supply can be maintained from each of these classes of Sandal-producing tracts; and it is possible that the same answer may not be suitable to the different provinces of Madras, Mysore and Coorg.

1.—Trees near cultivation, in hedge-rows, on grazing ground or private lands.

In 1890, Mr. Hill, then Officiating Inspector-General, wrote in an inspection note on the Coorg Forests.

"The present supply of Sandal-wood, coming as it does from village lands, cannot be maintained from this source; for, although some reproduction takes place in the *lantana* hedges, the young plants are greedily eaten by cattle and goats, and the people regard them with anything but favour" Recently, the Deputy Conservator in charge has expressed the opinion 'that he would rely mainly in the future for Sandal on those areas, protected forests and village lands, where the species grows best naturally, taking all possible measures to foster and protect all naturally-grown Sandal,' and has proposed "that while strictly maintaining the present Government monopoly in Sandal, the ryot should be given a direct pecuniary interest in the growth of new, and in the protection of existing Sandal trees on his land."

This proposal is supported by Colonel J. Campbell-Walker, Conservator of Forests, in Mysore, than whom no one has greater experience in growing Sandal. He writes—

"I consider that every endeavour should be made to secure the thorough protection of areas at the disposal of Government containing a natural growth of the tree, and the cordial co-operation of owners or occupiers of private lands in encouraging and protecting its growth, which I would do by a liberal scale of payment for each mature tree uprooted."

In so far as village and private lands are concerned, it must remain doubtful whether the owner's or occupier's interest can be sufficiently aroused by a promise of payment; 50 or 60 years hence, to make him think of either raising or protecting young plants in his hedge-rows. And trees which are out of reach of cattle are sufficiently protected by law, and no pecuniary interest in them seems to be called for. The only justification for such a concession to the ryot would seem to be the certain expectation that natural reproduction would improve, and the future supply of wood thereby increase.

As regards the protected forests referred to by Mr. Pigot, it is visionary to look for Sandal reproduction, so long as they are open to grazing and unprotected from fire; and if it is feasible to close them to cattle and ensure their protection from fire, there should be no objection to their reservation. As reserves only can they get the thorough protection advocated by Colonel Walker, and which Mr. Pigot doubtless allows to be necessary for the growth of Sandal. The desirability, however, of keeping up the supply of Sandal-wood from the first source cannot be gainsaid; and if the ryot can be induced to grow the tree on bunds and in hedge-rows, so much the better! We are somewhat sceptical of any very material results. On grazing grounds it is quite clear that only such odd plants as spring up under the protection of *lantana*, or thorny shrubs can survive and these must be in great danger from fire. Any areas at the disposal of Government which can be freed from grazing, must be available for reservation, and, as reserves, be capable protection from fire. It seems, therefore, that, notwithstanding that supplies have hitherto come from the first source, where, it may be admitted, the surviving trees seem to grow best, it is unsafe to trust to it for regular reproduction. There should, we consider, be no abandonment of it as a present supply, and every effort should be made to work it so as to make the supply as lasting as possible. It is, however, too Utopian, in our opinion, to look for a permanent supply of mature Sandal-wood trees from any open areas roamed over by cattle and goats, where the plants run the constant risk of being eaten, of being burnt by jungle fires, and of being hacked down by the villager.

II.—Trees in reserves, grown either naturally or by cultural operations aiding natural reproduction.

Colonel Campbell-Walker now writes.

"I do not assert that the tree cannot be reproduced artificially, i. e., by regular planting, but it is difficult, and, in my opinion unnecessary, as the same or better results can be obtained by thorough protection of existing areas so as to secure natural reproduction, and by cultural operations in the shape of sowing and dibbling seed under existing growth."

Mr. Hill wrote of the Coorg Forests in 1890.

"The reserves * * * must be looked to for the supply of the future, and these reserves contain very few old trees and but little young growth. The natural young growth of Sandal in the Jainkal belt however, points to the conclusion that in the Northern reserves much may be done by cheap cultural operations to introduce Sandal in quantity over large areas, where fire-protection is assured and there is little or no grazing. In the Sandal belt there are scarcely any old trees and the young growth seems to have sprung up under favourable conditions of soil and shade from seed dropped by birds. These conditions seem to prevail more or less over the hilly portion of the Gangawara, Ganaguru, Alur, Nitda and Yodavanad reserves, where not grazed over, and, if this is the case, the systematic dibbling in of Sandal seeds would be followed by the best results."

The Coorg Annual Reports up to 1896-97 show that, while some 1,700 acres had been treated with dibblings or cultural operations, all except 100 acres of the previous years, and 400 acres of the current year had failed, and scarcely a single plant had survived. It is said that the want of success was due in one case to late sowings, in another to excessive rain. But the experiment does not seem to have been either carried out with care and intelligence, or to have been fully reported upon.

In Mysore, about one-third of 14,000 acres of plantations, classed as stocked, was treated by the planting of *Casuarina*, *Albizzia* sp. and Sandal in pits. Neither the *Albizzia* sp. nor the Sandal seedlings succeeded, only the *Casuarina* remained and this proved an excellent nurse for Sandal, which came up from seed, over the remaining two-thirds of the 14,000 acres stocked. Dibbling or sowing *in situ* has been carried on to a greater or less degree. On the whole it is estimated that 20 Sandal trees have been established to the acre over the stocked area.

In 1896, Colonel Campbell-Walker reported —

"The most gratifying results observed in the shape of Sandal growth under *Casuarina* were certainly in the Lakkasandra and Krishnarajpura plantations. These blocks have an aggregate area of 753 acres, of which about 400 are classed as stocked, containing about 1,00,000 *Casuarina* of different ages.

The planting of *Casuarina* was commenced in 1888, when a few nursery-raised Sandal seedlings were also put out, but did not flourish. Dibbling was commenced in the following year, so the oldest Sandal plants are seven years old, and some are certainly 18 feet high, with luxuriant foliage and a healthy and robust appearance generally."

Now, if Sandal can be raised in this way, with *Casuarina* as nurses, there seems to us no reason why it should not be raised from seed by dibbling in all fire-traced reserves, where the conditions of soil and climate are suitable. The necessary protection from cattle will be effective, and it will only become essential to regulate the over-head cover, or

any undergrowth that may exist to the degree of density required by the Sandal tree in order to make certain of success :—

Colonel Campbell-Walker considers that in dibbling, the soil should be loosened to a depth of at least one foot, in patches, 6 or 12 feet square.

He says the plants will not stand 'drip,' and that the cover should not be too dense. He considers a suitable shelter to be that of bamboos and thorny shrubs, or *lantana*, if kept under control. The squares, he says, should be previously prepared, and sowing should commence with the setting in of the S.-W. Monsoon rains, and be discontinued during breaks. He adds, that it is better to do a small area well, than a large area badly, and that he does not believe much good is done by desultory dibbling or scattering seeds broadcast. This advice is well worthy of careful notice, and, in our opinion, the success obtained under *Casuarina* should show the way to the general introduction of the Sandal into all suitable reserved areas.

These would then be a safe insurance against any falling off in the permanent supply of the wood. It should be remembered that, once the seedlings are established and have reached a few feet in height, it will be necessary to give them gradually more light, and possibly in due time to free their crowns entirely.

Colonel Campbell-Walker was once of the opinion that the Sandal, like the Oak in Europe, likes its head free and the ground covered.* It will, we need hardly say, be necessary to proceed with the greatest caution in exposing to light a delicate tree like the Sandal, especially when it has grown under cover for years.

III—Trees in regular plantations.

Up to 1896 the plantations in North Coorg, as a whole, were considered a success, and the then Deputy Conservator was of opinion that, judging from the older plantations, they would be well able to supply the demand after a period of 20 years.

Colonel Campbell-Walker has recently recorded that he does not think we can rely on the plantations for our future supply. Mr. Pigot reported last year on the Sandal plantations of Coorg as follows :

"Of the Sandal plantations or artificial sowings it may confidently be said that their present condition does not warrant their being counted upon to supply 120 tons (or even much less) of wood 20 years hence. Their condition on the whole is unpromising, and a considerable part of their total nominal area of 790 acres should be written off.

* I think it requires moderate high over-head protection but plenty of side-light, with the soil at the roots protected by herbs and bushes.—J. S. G.

Mr. Pigot further reports—

"It is said that the conditions of the plantations in 1890, afforded every promise of success. The change for the worse has happened since, and specially within the last two or three years. In 1890, there were no trees aged from 20 to 25 years, and it is amongst the older stems that disease and death are at present common."

Now, it is observed that, when Mr. Hill inspected the plantations in 1890, he found they had been weeded to excess, everything being cut close to the ground, and the isolated Sandal trees left like fruit trees in a well-grazed orchard. He wrote "Weedings must be steadily continued through the second and third years, and even later; but, *as the plants grow up, only such growth as is actually over-topping them should be removed.* How has the injunction, given above in italics, been carried out? Turning to paragraph 39 of the Annual Report for 1894-95 we find.

"Even Sandal itself cannot stand very thick *lantana*. Lately I have had a few lines opened through dense *lantana* where Sandal had been sown some five years ago, and which was known to have germinated excellently, and for two years was not last sight of. In these lines, for every one weedy Sandal, nearly a hundred dry rotted stems were found from three to four feet high."

Again Mr. Pigot says—

"Other areas, such as the Frazerpett plantation, have completely failed, owing, no doubt, partly to the spreading and vigorous over-growth of *lantana*."

Would it not seem that the bad condition of the plantations is due to the very mistaken idea that, the more Sandal trees are smothered with close, dense, dripping cover, the better they flourish?—Before the existing plantations are condemned and their extension is given up, it is incumbent on those in authority to satisfy themselves that failure, or the unsatisfactory condition of the trees, is not due to any of the following causes—

- (a) The choice of an unsuitable site.
- (b) The absence of nurses or a suitable shelter-wood.
- (c) Insufficient stocking in the first instance.
- (d) Destruction by fire.
- (e) Destruction by animals.
- (f) Injudicious weeding.
- (g) Neglect to weed.

but to the absolute inadaptability of the tree to regular plantations. It seems to us that if Sandal can be grown with *Casuarina* nurses, in chance squares (we should call them 'pits') as advocated by Colonel Campbell-Walker, the steps to regular plantation are simple and only two, viz., to adjust the shelter-wood so as to afford the protection given by the *Casuarina*, and to bring the pits into line at regular distances apart. Then, given plantations raised and maintained to maturity,


there would be a regular permanent supply of wood from a limited area, which could be easily protected and exploited, instead of scattered over wide lands which cannot be protected from fire and cattle, and over which the exploitation even is uncertain and surrounded by difficulties.

In conclusion, we disapprove of the idea of abandoning the attempt to raise Sandal in regular plantations, by which means the greatest quantity can be grown on limited areas. We strongly second the proposals to introduce Sandal by dibbling in seeds throughout reserves that are suitable for its reception. And, while we see no objection to encouraging ryots to grow the tree, we deprecate any reliance being placed on a permanent yield from any lands which cannot be closed to cattle and protected from fire.

Thinnings.

The following is a somewhat free translation of an article in the *Revue des Eaux et Forêts* by M. Broilliard, which cannot fail to interest his disciples and our other readers.

"A thinning consists in lessening the crowded condition of the crowns of the best trees in a canopy, so as to favour their development." Such was the definition I formulated in 1874, while touring in the high forests of oak in Central France. By great chance I came upon it while looking up a note on the Hardt, and I found it again amongst a few passing remarks noted on the exotics in the Park of Coucheverny, and on the staves and headers of Blois. Have I stated it elsewhere? Whether I have or not, this is the general idea that has guided me in the thousands of operations of the kind, which I have had to direct since 1854, and to-day it still satisfies my conception, though like every definition, it remains incomplete, and is even dangerous. Comparing it with others, starting from the stems to be removed, the idea is seen to be quite different. Let us see the application of it.

Among our forest trees the oak is the one, whose proper bringing up is the most difficult, notwithstanding the fact that an oak wood, left entirely to itself, may be sometimes a marvellously fine sight. For an instance, one has only to visit the Plantonnee wood, in the Tronçais district, if it still exists; nevertheless we cannot look on a lot of oaks, 200 years old, and only 50 cm. in diameter, while another lot of the same age are twice as thick, without enquiring into the mode of treating the latter. They are not so tall, of course. The former, with boles of 20 metres long, give about 1 m. c. of timber each, and are worth 100 francs apiece. 

with boles of only 12 metres long, give $7\frac{1}{2}$ metres cubes and are worth 600 francs apiece. The one wood may contain two hundred of the smaller trees to every 50 or 60 of the larger ones in the other, but, apart from the money gain, the difference in quantity of material on the ground is not all loss, for many surplus stems will have been taken out in thinnings. There is no need for speculative argument, however; the fact is convincing. Slow-grown, soft-wooded oaks of 50 cm. diameter make poor planks, or, may be, a little wood for cooperage, whereas the trees of greater girth are good for every purpose. Let us thin out our crowded oaks, we shall in that way reap other advantages also.

A beech wood is constituted naturally, and, almost always as a dense crop, in which the stems lengthen and the crowns stretch up to even 50 metres from the ground, and almost always if the soil is deep, without risk of their future being compromised. But if left to itself, the beech forest, handsome as it is, does not turn over the capital, the value of the timber does not increase in proportion to its size, or anything like it, as happens with oak. Hence there is a general impression that beech high forest is a poor investment. In a general way, it is, but if thinned at short intervals, it gives a constant supply of abundant produce, even up to as much as half the current increment. These forests under timid foresters, so to say, are allowed to sleep, while in Denmark, under bolder hands, they realise 5 to 6 m. c. in thinnings, or almost as much as at the principal fellings. The facts and figures may be found at page 261 of my "*Traitement des Bois*" Since the beech after every thinning spreads out its branches at once, the soil remains practically always covered, the canopy fully complete, and the growth flourishing.

In broad-leaved high forest of mixed species it is another story. The ash takes for its motto "*excelsior*;" if it cannot get ahead of the rest it languishes and dies. The oak, also, is sore beset among the dense leaves of the beeches, maples, elms and hornbeam even; its finest branches are killed off, the most promising individuals are ruined. In certain high forests one may see the last of the oaks being strangled by the beeches, struggling by devious ways as thin poles, 25 metres long and a few inches thick, only to eventually die as slender starvelings. Such mixed forest calls aloud for thinnings, and they are not easy. To guard the crowns of the coming oaks from their infancy, when threatened by the froward birches, through their youth to their mature age, when ambitious neighbours still seek their ruin, requires both judgment and execution.

It may happen that the suppressed stems, the lower story, even the under-wood acquires a great importance for keeping crowns in a good state of growth. In the happy the forests of Bains en Vosge were in my charge, make thinnings among the oak and beech poles

One fine winter's day, while visiting a thinning being made in the 'Quart en reserve' of Bains itself, I espied a woodman, on the edge of the 'coupe' towards the Railway, carefully cutting back the seedlings of beech, which were thickly scattered over the scene of the thinning under the poles to be thinned. Perhaps he remembers to this day the compliment he got. Thinnings were only just coming into practice, and the poor man was only giving the coupe the usual "wash and brush up" as though it were a tan-bark coppice, where the operation is known as "ébrousser," "debroussailler."

It is easy to foresee the difficulty of thinnings in forests where the species are mixed in every possible way, but the complexity adds to the interest. I shall always remember my first walk in the Forêt de Haye with M. M. Parade and Nanquette, when I took charge of the Nancy-ouest Cantonment, which was about to be given over to the Forest School. Arriving from the Canton Anne Verjus, we proceeded along a compartment which comes to a point at the Cinq Tranchées. On our left, a very ill-constituted pole-crop dominated saplings of beech. In the absence of any officer, a brigadier had been thinning out the beech saplings below and cleaning the soil. "What a pretty sight!" said M. Parade, with a sly smile. "Yes," said I, rather warmly, "but the thinning is not made." "Well, make it!" was the reply. So, as soon as the leaves had fallen there was a cutting in the pole-crop. About 30 stères per hectare were taken out, aspens, beeches that were threatening oaks, coppice shoots overtaking beech saplings, and surplus stems of all kinds. Twelve years later M. Boppe thinned out the same 'coupe' and took out a lot more material, leaving from that time a nice young seedling forest of beech, oak and hornbeam over those 28 hectares that were formerly a tangled and disorderly mass of *supererogatory* stems. This juridical word was even used on another occasion a short time after by the first President of the Cour d'Appel to M. Parade, who was explaining the operation. The Magistrate had grasped the idea as one understands the definition of the term *thinning*, which indicates the classes of stems affected. The practical difficulty of discerning *which those stems are*, remains a matter of art and of skill.

With conifers, the matter is no easier than it is with the broad-leaved species. Look at a young pine-wood, uniform and crowded, and commencing to sicken in consequence. Every one of the crowns is a long narrow cone, reaching upwards and stretching for its life. Which are to come out? How many stems? Will the thinning be repeated and when? Can it be foretold? It is so difficult to differentiate, that one is tempted to fall back on a mechanical formula "*cut two out of three*;" or, perhaps, "*clear lines one yard broad, leaving two yards of forest between*." Nevertheless, it is possible for a clear-sighted forester,

aided by a careful guard, to do much better by lessening the crowding of the best stems without isolating them.

The pine-wood of Cervières near Briançon, in a level valley bottom, is stocked with mountain pine growing fairly fast. There I began my career. The forest was then a dense pole-crop, the thin stems no more than about 12 c. m. in diameter at breast-height, with a short and narrow pyramid of twigs by way of crown at 12 or 15 metres from the ground. They were sick and seemed that all they could do was to stand upright. I marked a bold thinning, and got a first-class stiff neck over it. I have not seen it since, but two years ago M. Algan, the *garde général* there, sent me a fine photograph showing the trees and men working among them for comparison, together with a description of the crop showing that stems of 40 c. m. are not scarce. These stems have, therefore, put on 30 c. m. of diameter in 40 years, to their original size. And still I have heard of another such dense and dark pole-crop at Gandissart, which at 60 years of age, on a cold slope, is still in that stage. The Briançon people say "they have always been so." But certainly they have not, for they only began life 60 years ago and must have been growing since, though at an imperceptible rate. They have never been thinned.

The larches which shoot up more rapidly, protect themselves better from a crowded condition; for the dominant stems go ahead and get the mastery; all the same uniform-aged crops from a single sowing often suffer considerably. This is seen. In the ordinary fellings for right-holders, or other fellings not fixed by area, it often happened that instead of following the paradoxical idea of some worthy unknown, and felling the finest trees, I would particularly select those that were troubling their betters, thus making a true thinning. The right-holders did not always like it, naturally, and one Mayor, he of Villars St. Pancrace, fell upon me with some heat. There was more waste heat some time later, when a big fire occurred in his village and it had to be rebuilt. Then the right-holders were uncommonly glad that the best trees had been preserved 20 years earlier.

In silver fir woods, though less indispensable, the thinning is still of great service. Besides permitting the disposal of surplus increment, it induces the sustained development of magnificent trees. The silver fir, though resisting indefinitely the pressure of its neighbours, often finds itself too crowded, as it advances in age, and it is a good deal better off for a little thinning out of trees of the same height; but the work must be gradual, for sudden changes of condition are dangerous. This species loves tranquility; it amplifies its foliage but slowly and never much; it likes coolness and freshness, and suffers from the introduction of sun and wind. Thus, if isolated after being brought up in a canopy,

it dies. We cannot alter nature. The silver fir loves a close canopy, let us take good care never to open it out. I, myself, coming from woods of pine and larch, was at first too bold among the silver firs, too much inclined to give them an excess of *air* as is commonly and wrongly said, instead of *light and space*. There was a compartment "M" of the forest of Grand' Cote, on a poorish soil with scattered boulders. Here I made a rather severe thinning. The felled stems fetched one penny each. Fortunately the poles were quite young, and we preserved the underwood. Feeble benefit on all sides, and a dangerously excessive thinning! After this experience I became more cautious in dealing with silver firs.

Among the spruces it is again different. This species is somewhat cosmopolitan; it can flourish equally well as an isolated tree on a pasture, or in close canopy. Yes, provided it has been brought up to it. In close canopy its roots are as scanty as its wig; if it is isolated late in life, the roots are wrenched about and the tree dries up. Our friends, the Swiss foresters, led on by enthusiasm, are perhaps trying how far they can go. The idea of thinning, *par le haut*, could not originate in spruce forests, and if I have contributed towards spreading it so far, I should, nevertheless, be sorry to see it carried to extremes. The thinning among the tops is indeed useful to spruce, but this species is certainly the one that has least need of it, and can do very well without it. For instance, see the splendid forests of the Ebenwald (Revue of 15th August 1898, p. 520), 800 to 900 stems to the hectare at 130 years old. There are also instances in France of forests that have never known a thinning. The rate of vegetation per tree is exceedingly slow, but what splendid sawyers' wood! And what a growing stock peacefully slumbering on foot! up to as much as 1,200 m. c. per hectare, at 120 years old. At 20 francs the m. c., the stock is worth 24,000 francs per hectare, which corresponds to a mean annual revenue of 200 francs per hectare. Is that not sufficient? May we not reply, like the young girl did to her Priest, "since those who marry do well, I will resign myself to it; let those do better who can." She omitted to state that she was in a violent hurry to get married. We are in the same situation with regard to the spruces. Who cares to watch a forest quietly growing for 150 or 200 years, without interfering, beyond the removal of the dead or dying trees? It is a good thing, nevertheless, in a few unfrequented parts of the mountains to spread the increment over thousands of stems, producing timber of the finest quality, even fit for sound-boards with rings only one millimetre thick. One is exceedingly glad to have such marvellous produce of long years and nature to sell, but who will consent to let his own woods grow at the rate of 20 centimetres per century?

Given a pole-crop of fine up-reaching spruces, the question is, what ought to be taken out in order to obtain a little produce and at the same time to improve the growth of the better stems? The answer is less evident, and the need for prudence is greater here than in almost any other forest. An even-aged pole-crop of pure spruce about 40 or 50 years old, may contain 2,000 to 3,000 stems per hectare. Many of these, being completely suppressed, are no longer an annoyance to their neighbours, but on the contrary are a decided gain, inasmuch as they improve the consistence and solid appearance of the crop. There is no good reason for their removal till their leading shoots have dried up, or some fault shows itself. The real struggle in the upper story thus lies among some 1,200 to 1,500 crowns. This is too many for us, it would mean less than half a centimetre annually on the diameter. We can gradually reduce the number by gently freeing the best and most vigorous crowns, but the crop is one united whole, inter-dependent and inter-responsible. Any sudden openings may tear or loosen the roots of one or two, and in consequence endanger the whole lot. This must be avoided. By working gently and frequently, say, every six years, only removing each time one crown out of, say, six in the upper story, twenty-four years will see the number reduced to half. Under average conditions of growth, this is going quite fast enough. As the crop gets older, the *proportion* to remove becomes less; after 80 years old it is small; and in a pure spruce crop, aged 100 years, there is very little to be done at all in view to its improvement, whether it has been previously thinned or not.

Which stems are to be cut in thinning the pole-crop? Those which are troubling the finest trees are naturally indicated. They are easily recognised, and must be removed gradually, one at a time, long before they are dominated. Thus, the crowns of the stems of the future get the best of the open air above, while their roots are freed from the struggle with those of the trees removed.

M. Guinier (in the *Revue des Eaux et Forêts* for 10th April, 1896) has indicated that in a pure spruce crop the trees to come out are those with narrow crowns. "*Etriquées*," from *strictæ*, seems to mean "narrow by reason of crowding." But, if all the narrow crowns are removed, there will be great risk of interrupting, impoverishing, and ruining a crop, however complete it may have been. Let us, therefore, say that the more aggressive among the narrow crowns are to be removed. Actually, in dealing with the operation of thinning, what one has most to guard against is excessive zeal. In trying to do too well, there is risk of doing very badly; one must know how to take sufficient time over the operation. This is the conclusion come to a few years ago, by a friend and myself, when discussing matters under the young wood

of Petite Fravelle, to the west of the *pré de la Messe*, where I had watched over its birth and its rapid growth in the early years. The surplus stems having become numerous, it would have been an interesting task to eliminate a few of those most hurtful to their neighbours, and it appears to me that a forester who once carries out a successful operation in such a case, ought not be diffident of his ability to do the same in any other conifer forest, and take an enjoyable pleasure over it.

Among the silver firs is it not far easier? Those that are suppressed, persist on and on for a very long time in the underwood; those that dominate, gradually enlarge their heads; the surplus crowns become deformed and condemn themselves. Add a few diseased, injured, or other hopeless stems, and the thinning goes by itself; any subordinate accustomed to conifers could do it. Then, the admixture of beech is a great assistance from its adaptability and general utility in aiding to complete the crop. Similarly, matters are simplified if there are silver firs among the spruces; each silver fir will become a mighty patriarch, surrounded by the spruces, which derive from it both support and fresh moisture in the soil. For further study of thinnings in silver fir, reference may be made to the "*Traitement des Bois*," where it is fully treated.

Most of our silver fir forests have been treated under the Selection method, and contain stems of all ages, mixed up together, which are consecutively reaching maturity. Then, they have to be removed, and sometimes their extraction is combined with a true thinning simultaneously. It would be safer to make the thinning two or three years later, when the absence of the large trees would allow a better insight into the requirements of the crop. But to return to our crops of uniform age.

Take scotch pine.—In this case the crowded state must be guarded against. The idea is here again easier to grasp than to execute. Still, when the pine tree is of natural origin, it is always more or less irregular, sometimes containing a few broad-leaved specimens, if only the transitory birches, which will shortly execute a natural thinning of themselves. The idea to grasp is that the pine lives in a canopy, open but evenly distributed, quite a different style of thing from isolated trees. This, once realised, the forester will free, without isolating, one or both sides of the crown. The operation is far more necessary here than in silver firs, and more remunerative.

The pure beech forest is the birthplace of the systematic thinning, which consequently presents no difficulty there. Free boldly at first and much more gradually later, or if preferred operate often in youth and at longer and longer intervals later. Either rule will give good results. Each time a number of thin or aggressive crowns, greater or smaller in proportion to the bold-

ness and date of the previous operations and to the rate of growth, will be cut out. The definitions of the term *thinning*, based on the *number of stems to remove*, arose in these high forests of pure beech, and are not safe to apply elsewhere.

As these crops grow older, an undergrowth of beech springs up, which remains starved and never coming to anything under the cover. Though probably useful, it is of little importance whether this exists or not. If it comes, leave it; if not, do not seek it.

Under the beech high forest of Dayancourt, aged 180 years, at Villers Cotterets, amidst a scanty underwood, notwithstanding the elevation of the very lofty crowns, M. Bagneris, who carried a long iron-shod stick, drove it in up to the top, so light and loose was the soil. How the oak would have equally prospered under such conditions! In similar soil in the Canton des Epinais, there is an oak called by the young folk the *chêne à l'unité*. It is 1 metre in diameter with a timber length of 20 metres, and therefore contains 10 m. c. of 1st class timber, worth 1,000 francs.

A high forest of pure oak (*robur*) must be properly thinned if it is to come up to expectations. The strangled crowns become very marked. By removing these and a few others that are simply over-crowded or supererogatory, the growth of the better trees is wonderfully improved. These will acquire diameters equal to one-fifteenth or one-twentieth of the timber length, instead of being limited to one-thirtieth, one-fortieth or even one-fiftieth. This is all profit, both in the present produce of the thinnings and in the future higher value of the timber per foot. One hundred oaks of 80 c. m. diameter and 15 m. long would give 500 m. c. timber and be worth an immense sum. Is not this the proper object in view in these high forests?

In course of time an undergrowth usually springs up which is encouraged by the thinnings. Whatever it may be, it will help to keep the soil light, in good condition, porous, moist and substantial; while it will be all the better should the undergrowth differ in composition, containing instead of oaks, for instance, holly, hazel, hornbeam, beech, &c. But these latter will rise up under the light cover of the oaks until they interfere with the good growth of these latter. Even under cover they seem to have the advantage and to struggle successfully. I have noticed this in several forests notably at Fontainebleau south of the Croix Saint Hérem. It is therefore advisable, when the thinning comes due, to cut back at the same time all such strong-growing species like beech, and especially hornbeam. Possibly, their roots may damage the oaks as much in the soil as their crowns do in the air. I suggest this point for further enquiry.

This brings us to the study of the mixed high forest of oak and beech. The difficulty of bringing up, or even main-

taining the oak in this mixture is only too real, but forewarned is forearmed, for we have the means of overcoming it. I have in this place already indicated, in my study of natural regeneration, the way to obtain oak seedlings among the beeches. That question needs no further mention. The regeneration fellings will be hardly finished before there is a mass of saplings in which it is not very difficult to throw back the beech, but it must not be cut back to the ground, but only to the height of 5 or 6 feet. Thin weeding must be thoroughly done, not only round each oak, but over the whole area. The beech will start afresh quite sufficiently. Ten years ago, M. Viney did this in coupe No. 5 or 6 of the forest of Oiteaux, on the left as you enter by the road leading from Chocelle to St. Nicolas. The result to be aimed at is the preservation of oak everywhere, with beech below it, even from the sapling stage.

The little oak poles soon begin to appear as such, the beech springs up between, and it is soon time for the first thinning which will remove principally beeches round the oaks. This time they are cut down to the ground and the oaks will spread and complete the canopy. The beech will undoubtedly remain in the coupe. The succeeding thinnings will boldly attack the biggest beeches, because they are the most dangerous, and in this way the oaks will be kept flourishing. Further, any beeches actually *below the oaks*, but reaching up into their chief boughs, can be cut back. In a coppice with standards the oaks are readily preserved and fostered in the struggle with beech, but this is done only by isolating them about every 25 years. In high forest we can do better by means of repeated and fearless thinnings.

The pedunculate oak, mixed with beech in certain forests such as Mormal (Nord), is generally found in moist places associated with most of the local broad-leaved species, softwoods, ash, elm, hornbeam, &c. It may attain colossal dimensions, but too often it is only found scattered here and there. It is, therefore, necessary to secure its regeneration if not abundantly, at any rate, generally. To this end, successive regeneration fellings are made, and at the same time the seedlings of shade-giving species among the oaks are cut back. It is a certain way of building up a forest. The following note, taken from M. Clement de Grandprey, a former Inspector-General of Forests, relates facts which illustrate this admirably.

"The forests on the immediate banks of the Rhine grow on stony, sandy, or fertile mud alluviums. In the first case, Scotch pine springs up naturally. In the second, a forest of every possible species. The pedunculate oak does exceedingly well, and even in some cases forms a splendid crop all to itself, notably in the State forest of Drusenheim, the Communal forest of the same name, and over 80 hectares of the Canton Steinwald in the Commune of Gambaheim.

Below the oaks is an impenetrable thicket of all sorts of species. How could such a crop arise? For the old crops who shall answer? But I know very well how the young ones were created. Some of these are faultless, and I have never seen better, unless perhaps on the banks of the Adour. When Alsace was still French, all the forests within 5 kilometres of the Rhine were subject to the supply of brushwood for fascines, &c., for embankment works. Consequently, the Forest Administration claimed little concern with them and they were made over to the Ponts et Chaussées. The engineers located the coupes, which were cut by contractors, without the remotest respect for anything. But fortunately there were a few old forest guards who got work there. These men could not bear to see all their instincts and traditions so ill done by, and of their own responsibility they persuaded the workmen to leave the oaks and elms which were found in the thicket. As the fascine-cutting came round every five years, the proceeding was tantamount to an excellent cultural operation and produced the crops that I so much admired."

The hint was enough for M. de Grandprey. Being appointed to Haguenau, he got hold of the fascine-forests there, submitted them to a rotation of 5—8 years, and thus continued the good work begun by those grand old guards. Where oak seedlings were wanting, he sowed broadcast, and success was assured.

Returning to our forest of beech and pedunculate oak. The development of the sapling of the latter amongst the suckers and coppice shoots of all sorts has to be followed with care. Thinnings are indispensable among the fast-growing wood. It is now a case of isolating the species with a light cover such as birch, ash, aspen, bird-cherry, even alder; with their high shelter, they will protect the young oaks from the spring frosts, while the species like elm and lime, that would suppress the oaks, have to be cut down. Thus, frequent repetitions of light thinnings will bring up the young oaks as they should go. Thereafter, thinnings at 10 or 12 years' interval will be necessary to liberally free the crown. But in soils where the auxiliary species attain a height of 25 and 30 metres, the mere freeing of the crowns will not suffice to give to the oaks all the space they exact. This fine tree loves to develop in girth and this can only be effected by assuring it ample liberty on all sides. As soon as the oaks have 12—15 metres of bole, the best attention should be given towards isolating the crowns of the choicest trees and maintaining them in this state by successive thinnings. The neighbouring crowns, kept at a limited distance, will continue to shade the bole, and as the oak grows and enlarges its crown, these trees will gradually disappear.

The various species naturally mixed will be far from possessing the longevity of the oak, and may reproduce again below the oaks an uneven and most useful underwood. Thus managed, a pedunculate oak forest, often interlarded here and there with

ash and elm, will do wonders. Such crops are exceptional in France, for lands that are irrigable or siltable are mostly occupied by agriculture or meadows. Even in the low-lying forests, it is frequently only in a few compartments, and especially along water channels within flood limits, that the genuine forest of pedunculate oak, alder and ash or elm, the true meadow-land forest exists. Generally, it is worked as a short rotation coppice with standards; this is easy, but in these coppices the oaks are often but thinly scattered and leave much to be desired on the score of shape and soundness; really valuable trees are scarce. The treatment of the pedunculate oak in high forest by the bold thinnings that are requisite for its luxuriant growth, gives produce of incomparable quality. Look at the oaks, growing among alders, cut every 15 or 20 years; imagine 50 of them to the hectare; fancy them double their present height; calculate their value at 120 or 150 years, when they will girth 8 or 4 metres, and see what it comes to!

The pedunculate oak is found also as high forest, even pure, on poor sand, but what a contrast! In 1869, under the pleasant guidance of M. Le Tellier, it happened that M. Bagneris and self visited the forest of Boulogne, which is contiguous with the park of Chambord, in Sologne. There, in the Canton des Theilletts, we saw a high pole-crop of pure pedunculate, aged 100 years, very full but slender, ill-shaped, and only 20 cm. in diameter. It reminded me of the "Sleeping Beauty." At Compiègne, too, Canton des Vineux, there is a sorry high forest of pure pedunculate oak, originally planted, whose boles, already garnished with epicorms, make them appear to fear a thinning. The feeble crowns, the soil covered with heath, give no hope of a spontaneous restoration to better things. Had there been a mixture of beech, or an undergrowth of hazel, one could have thinned out the oaks and made something of them, though they are always ill placed on dry sands. Isolating them now would kill them; all that can be done now is to give them the thinnings and treatment appropriate to *Q. robur*, under similar conditions.

The above seems to me the procedure suitable in thinning our two oaks under various conditions. We shall thus realise the desirable ends set forth 75 years ago (*Revue* of 1st December 1898) by MM. Mallot and Le Grix, naval constructors. In many cases it is done already, and though our ships are now built of iron our oaks are not less in demand, for the price is greater than ever notwithstanding the general fall in prices.

The reader who has survived up to this point can now understand my views of the way thinnings should be made, *my style* in short, which I am far from alleging to be *ne plus ultra*; there are too many things we do not know. In any case, he will have seen that a thinning is not a simple operation, and that it varies exceedingly, between the spruce

growing pure, which can dispense with it, and the meadow-land pedunculate oak, whose crown by spreading freely gives to the annual rings ample thickness, strength, and quality. From one point to the next, at each individual tree, so to say, the thinning introduces different conditions. Satisfactory work can only be done by never losing sight of the guiding idea, and by having a close acquaintance with the life and behaviour of each species, pure and mixed, in every possible way. Such skill is only acquired by those who live in, and with the forest. It is infinitely easier, safer, and in every way more satisfactory to show the operation *in situ* in the forest than to explain it on paper. What the eye sees the mind may understand, but mere reading leaves but vague ideas, for no *complete* idea can be given of the *extent* of thinning. On the ground, it is the application of the main idea to individual cases that enlightens. It is the same with pruning fruit-trees, in fact with all questions of art. See it done, then read as much as you like, such is the only safe road to skill. It is, therefore, not without some apprehension of danger that this article is published.

Thinning is not only a delicate operation. However you attack a growing crop it is dangerous. The blighting of the whole crop and the degradation of the select stems has to be guarded against in different measures according to the soil and species, and these vary infinitely: particularly in mixed forests. Therefore, I have previously stated (*Revue* of 10th June 1896) that there is no definite formula for a thinning, there is no process or equation by which one can determine the number of stems to remove, or lay down which they are. This has to be done through knowledge of the various species, their temperament, exigencies, faculties, mutual relations, &c. But I think this is enough. I have known men who did not know *x* from *y*, forest guards even, who, having grasped the idea, could act on it and do very respectable work indeed in their own forest, their own beats. One of the most remarkable of these was brave old Antoine Gautherot, of Saint Broing near Gray. He was a woodman who became a guard in a private forest. He had never left the woods of la Vaivre, which surround the ancient Abbey of Corneux. In winter he could not tell *Salix alba* from *Salix fragilis*, but how well he knew the oak and the ash, the red elm with its two homonyms *white* and *diffuse* (though he knew not the name of the latter), and the alder, the aspen, the hazel, and the rest. He lived among them, his life was of theirs, he felt their difficulties, and did exactly what was needed. That is no trifle, I assure you.

The operation of thinning thus may be, nay always is, dangerous; the greatest danger is that of interrupting the canopy, and it must be carefully avoided notwithstanding the temptation to make a nice open crop. After what I have said about pushing the thinning of *Q. pedunculata* to the state

of isolation, I hope to escape being called an advocate of complete canopies at all costs, but how necessary the complete canopy is ! What good are isolated conifers ? Good to be cleared off at once ! What future has a high forest of beech if opened so much that several years must pass before the canopy is re-formed ? It is the future of a crop well on in regeneration fellings. Even *Q. robur* itself may be made to suffer, in the soil and in the air, to the extent of imperilling the future of the crop. Complete canopy is the natural state of forests, let us improve upon it only in showing proper regard for it.

Another great danger in thinning lies in the removal of the finest trees, be they silver fir or oaks, larches or beeches, pines or others, under some pretext or other. Crops so treated consist of a languishing residuum of unprofitable, feebly-growing stems, mostly of useless species, with a plentiful sprinkling of blanks which will not fill up. Concoctors of disastrous theories should be handed over to the hangman, and that without appeal, unless to the owners whose forests they have handled. If these latter are satisfied, so much the better ; but for our part let us keep our complete canopies filled with our best trees.

A third danger is that of a too heavy thinning, making openings in silver fir woods, gutting a high forest of oaks, destroying the due mixture of secondary species, or simply separating the stems too widely. The result is a shock to the constitution of the forests and a crisis in its existence. What our long-lived forest trees really require is a regular and sustained development ; the proof is easily seen by comparison of the two or three-hundred-year-old crops that still exist in a few forgotten, out-of-the-way forests.

From another point of view, heavy thinnings, but still made with prudence and frequently repeated, furnish a good deal of produce, which supplements and sustains the regular yield, sometimes makes it possible to await the due period of maturity, and becomes as important a factor in the revenue as it is in the treatment. It is known that a beech forest, according to soil, may give thinnings amounting to half as much, or even quite as much, as the principal produce. But the quantity can never be determined beforehand, since it depends on the ideas of the operator. In case of competition for the produce, a case of usufruct for instance, the question arises, " Who shall be judge between the parties ? Who shall see that the owner cuts enough ? Who shall see that the right-holders do not get too much ? Who can decide such a technical question, but a skilled, professional forester, called in specially and sworn to the task. The rules and limits by which he will be bound may vary within wide limits from one place to the next, here five or six stères may come out of 10 ares, there nothing at all. Thinnings are becoming more and more matters of daily

practice, and though they are at present ignored by the Civil Code the day is not distant when the owner of the bare land will be forced to surrender their produce to the usufruct beneficiary or the holder of the ground rent (emphyteutic tenure); it is the opening of a new state of things which the 20th century can only emphasise and confirm.

Lastly, the value of small material is falling to nothing, and that of all classes of firewood is similarly affected, whilst every kind of timber is more and more sought after. The deduction is self-evident. The future is for High Forests, complete high forests; standards over coppice with long rotation; plantations of conifers, all kinds of timber trees. The future is, therefore, also for thinnings.

Some owners wish to know how many stems per acre they can keep on foot at given ages in a regular crop. I have already said that there is no formula. It is easy to show the absurdity of expecting one. An oak pole-crop, aged 30 years, may comprise 4,000 to 5,000 stems per hectare, but only about 1,000 really forming the main crop. On cutting out the feeble and useless, there remain 1,000 stems suitably spaced. Ten years later, at the age of 40, half may be cut, say 500; at 50, cut a third of the remainder; at 60, one-fourth, and so on at equal intervals, one-fifth, one-sixth, one-seventh, one-eighth. Then, at the age of 100, there will remain $1,000 \times \frac{1}{8} = 125$ dominant oaks. Continuing as before there remain

at 120 years	$1,000 \times \frac{1}{10} = 100$ trees
150 "	$1,000 \times \frac{1}{18} = 77$..
180 "	$1,000 \times \frac{1}{16} = 62$..

Now, do the same for a spruce forest aged 30 years containing 4,000 stems, all included in the region of practical politics.

At 30 years old there will be	666
100 "	500
120 "	400
150 "	300

A silver fir wood aged 30 may contain 2,000 principal stems. Treated in the same way, it will, at different ages, contain one-half the number that the spruce has. What sort of result is this? Finally, whatever the species and the number "M" of stems contained at 30 years old in the complete crop, it may be thinned by the formula

$$M \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \dots \times \frac{n-1}{n} = X$$

Under the definition by which this article begins, the number of stems to be preserved at different ages is, therefore, fixed by the formula

$$X = \frac{1}{n} M$$

The progression may be accelerated, or diminished according to the soil, by making intervals of 6 or 8, 12 or 14 years. The hyperbolic curve may be constructed, directrices and asymptotes marked out, and so on. What a treat for a mathematician, turned forester by mistake.

F. G.

II.—CORRESPONDENCE.

Regulation and utilization of Water in mountainous countries.

SIR,

Some very interesting contributions have lately appeared in German Forest publications regarding the regulation and utilisation of water in mountainous countries. Large sums of money have, of recent years, been spent by various Governments on the afforestation of the upper reaches of mountainous and sub-mountainous streams. France disbursed, within comparatively few years, 45½ millions of francs on the afforestation of some 62,500 hectares of ruined forest lands, and Switzerland, 1½ millions of francs in 8 years. Austria also has spent large sums for this purpose and can show excellent results. Curiously to say Germany has held back, though the Rhine-floods of 1868, and in subsequent years sounded the tocsin of war, ringing with unmistakeable clearness, and this became more and more pronounced as the construction of new railways, roads, etc., tended to encourage the more rapid off-flow of water. *Tout comme chez nous* in cases of famine, plague, and opium; a commission was formed, statistics were collected, and more or less valuable reports were issued. Since 1870, however, the question has been taken up by practical foresters in charge of divisions, and far reaching results have been obtained by the excavation of small horizontal ditches on the contour lines of the hills.

Various experiments have been made in the course of subsequent years as regards the size and length of such ditches, but it was eventually found that small and numerous trenches gave the best effect.

They are now being made 30 cm. by 28 cm. by 25 cm. and of 4—6 metres long, 5,000—6,000 metres costing about £3 per hectare, with a daily labour unit of about 2s. Up to 1898, some 20,000 hectares had been treated in the forests in the sub-mountainous regions of the drainage area of the Rhine. It has been proved that this treatment has not merely an immediate direct

effect, but acts most beneficially on natural reproduction and facilitates afforestation of ruined areas.

The experience gained should be of great interest and value to us in India, and with no lack of suitable sites in the School Circle, it would seem to be a matter for serious consideration, whether experimental areas of some extent should not be treated in this manner.

S. A. C.

Erythrina Indica

SIR,

With reference to the remarks of Mr. Woodrow on the above tree, quoted by Dr. Prain at page 468 of the "Indian Forester," Volume XXIII, that "nobody ever found it truly wild anywhere except on a sea coast," it may be of interest to mention that it is common in the dry hill forests of the South Thana Forest Division, about 50 to 60 miles inland, away from towns and villages. It is seen also in the mixed forests of the Tansa lake catchment area. The tree never, however, attains any size, being about 15 to 20 ft. high and having a girth measurement of about one to one-and-half feet. In some of the coupes situated on low hills, the trees are usually much smaller, being not more than 6 or 8 ft. in height and crooked. I have seen the tree in Sind, at Hala, North of Hyderabad, but not growing wild.

G. M. R.

16th February, 1899.

IV.—REVIEWS, &C.

Arboriculture in the N.-W. P. and Oudh.

The Report on the Arboricultural operations in the North-Western Provinces and Oudh for 1897-98 is rather sad reading, for it amounts to a confession of failure. Mr. J. S. Meston, C. S., is the Director of Agriculture, and his definition of the aim of his Department is that "for the Provinces as a whole, the 'revenue from grass and wood should easily cover the annual

'allotment for planting and maintenance of trees, and' until 'this is effected, I am convinced that our administration will be 'defective," while the Government endorse this and hope that "the time may not be very far distant when the arboricultural 'operations in the Provinces, as a whole, may be found self-'supporting." Now, if the arboriculture were managed by the Director as a central authority, it is possible that this result might be obtained, for he would be able to hold the balance and work up the revenue uniformly; but as the Provincial road avenues are under the Public Works Department, and the Local road avenues under the District Boards, it would not seem as if the Director has very much authority. We see from the appendix which gives the Revenue and Expenditure that, out of 48 Districts, only 12 have the revenue equal to, or greater, than the expenditure, and that the average financial results of the last six years, as a whole, were :—

	Rs.
Revenue	... 52,278
Expenditure	... 69,769
	<hr/>
Deficit	... 17,491

which is, after all, not much for a great Province to pay for having shady roads.

The arboricultural work in the Districts is managed under 'Working Plans,' but the nature of these Plans does not transpire, though it would seem that they are useful and necessary guides for a control of the work. We spoke above of a 'confession of failure,' and our remarks require justification by an extract. The extract runs as follows :—

"That our administration is defective in many details is 'beyond question. During a prolonged cold weather tour I 'have had an opportunity of seeing many roads and roadside 'avenues. I have seen young trees planted out on unfavourable 'soil, with no adequate protection and with absolutely no dis-'crimination. I have seen in the Bulandshahr district trees 'planted in holes along roads in marshy country, where they 'must assuredly rot and die in the first rainy season. In the 'Unao district I have seen delicate trees planted, without any 'special precautions, on usar soil, where the hardy babul can 'rarely be induced to grow. Elsewhere I have seen trees put 'down and left unwatered or untended till all chance of their 'survival was past. In other places, as already noted, the 'tending is excessive: the young plants are imprisoned in huge 'clay *thalds*, where they cannot breathe, or are soured with 'water till their roots are drowned. It is difficult to teach 'wisdom in such matters. District Officers have no time to 'lecture roadside *mális*, and *tahsildars* have many more im-'portant duties to see to."

"Two officers of large experience and much personal interest in the work, whom I consulted during the year, made no secret of their opinion that public money is being wasted on arboriculture as it is now conducted. One of them went so far as to recommend that the allotment now made by Government for the whole provincial operations should be confined to the work in a few districts at a time, where, under systematic and economical supervision, the roads could be all supplied with avenues of viable trees in three or four years; and the allotment could then be moved on to another set of districts. The project is not without its difficulties, and I think we must give our new quinquennial working plans a fair chance of proving their utility before any such radical change in the system can be commended to the attention of Government. What we should strive to attain are good shady avenues of useful and, if possible, fruit-bearing trees along all our metalled roads. If this object is secured, we need not struggle to plant out every kachcha road in the Provinces. By the ordinary native who has to travel along the rough country roads, an occasional grove and a well, where he can rest and quench his thirst, are much more appreciated than the regular avenues of the landscape gardener; and I venture to think that if this were borne in mind, much routine planting on infertile soil would be avoided, and our arboriculture would be re-arranged on more economical and sensible lines."

On this the 'Pioneer' recently made a comment, which is a very natural one so far as the supervision of the Collector and his Civilian assistants go, but what, we take it (and in this we agree more with the opinion of the Chairman of the Etah District Board, than with that of the Commissioner of Agra), is wanted, is that the Tehsil and other uncovenanted staff should be responsible for the avenues in their charges and should, in some way, be made to acquire the simple elements of arboricultural work, and that, we think, cannot be done, until such officials are made to pass through a training school just as are officials in the Public Works or Forest Departments. The 'Pioneer' said:

"So thought former Collectors of the old *régime*, who loved and knew districts and carried out their ideas successfully: so did *not* the present generation of young officers who hold their appointments for about six months on an average. Mr. Meston says: "District Officers have no time to lecture road-side *malis*." The fact is the District Officer of the present day neither knows nor cares to know his district in which he spends so short a time: he is a mere inspecting officer, slaving to get in his revenue, or make his excise settlements, or carry out a hundred other similar duties, and has no time for "fancy" work, like

'arboriculture. And so, insensibly but steadily, deterioration 'goes on in a hundred other little ways all along the line.'

Mr. Meston's solution of the question is "to enlist the 'interest of a larger number of Tahsildars, Naib Tahsildars and 'District Board members, but we do not think that this alone would be much good," at any rate as regards District Board members, for, unless the Collectors were fairly permanent and interested in the subject, those members would hardly think arboriculture a paying subject to take up. What is wanted is simply to have one or two men (not necessarily *malis* with strong preconceived notions about work, but men like good Forest Guards, who have been trained to correct work) in each District, who know how the work should be done, and to have Tahsildars, at any rate, sufficiently instructed to be able to tell if what is being done, is being done properly or not. All natives have certain little 'superstitions' about tree treatment, which we have found not to be wholly eradicated even by the course of practical instruction that is given at Dehra Dún to candidates for the Forest Department. One such is that, in planting 'avenue' or 'grove' trees, it is useless to put in only *one* plant, but that two are better and the result is that, instead of having one straight-growing, good tree, you get two miserable saplings which twist themselves about each other and form a sort of low-branched bush. Only a few days ago we saw this done by an ex-Dehra Dún student! Another is that such plants should be always put into pits, and left with the base of the stem 6 inches or a foot, or even more, below the surface of the ground. The result, of course, as every Forester knows, is water-logging, which is a far more frequent cause of death than drought. Young trees should be planted at ground level, or a little above, to allow of some sinkage of loose earth and facilitate watering if that proves necessary. Another is that in nurseries, small trees should be transplanted, or rather 'pricked out' as rice is treated, practically by pushing it into the ground with the thumb and so bringing the roots to point upwards as much as the stem. We have frequently seen this done by those, who ought to have known better, and the usual *mali* is an adept at this practice. Then there is the superstition that any operation that hacks off a bough is pruning. We saw, only a few days ago, an avenue tree within a mile of a Government Garden, managed by a professional, who presumably never was consulted, which had had a big bough cut off at about a foot from the trunk, but the cutter had never thought of the necessary preliminary undercut, so that, in falling, a large slice was torn out of the tree, some 4 or 5 feet long, and a foot or more wide. Even in the Dehra Dún District, within a mile of the Forest School and under the eyes of perhaps a hundred Professors, students or labourers, any one of whom could have told how it should be properly done, we have recently had the awful spectacle

of a piece of the most ruthless and terrible 'pruning,' that could be found by any one, who wished for a practical example of 'how not to do it.'

And this leads us to another reflection which has occurred to us on a perusal of this report and that is, that although the Province has in its area the training Forest school for all India, and though in at least a dozen of the Districts concerned, there is a professional agency whose advice could, we should have thought, have been sought for, there is nothing to show that that agency, the Forest Department, whose officers are everywhere more or less at the disposal of the Collectors, and whose Conservators are the proper advisers of Commissioners, have ever been consulted. Surely, it is rather strange to have the Director of the Department of Agriculture moaning over the want of petty technical knowledge displayed in avenue planting, when he has never attempted to consult the professional knowledge, which the Government possesses in a special Department. Can we imagine such a thing occurring in France, or in Germany, or in America, or indeed in those colonies where similar agencies exist!

An interesting subject discussed in para. 9 of the Report is that of the 'Description of trees planted' on which it is said:

"The trees planted on roadsides during the year under review were, with few exceptions, of kinds recommended in the Circulars issued by this Department. *Siris* trees, varying in number from 115 to 300, were planted in Budaun, Mirzapur, Rae Bareilly and Jaunpur, and 453 *nim-chameli* trees in Etah. The *nim-chamelis* were planted without the knowledge of the Board, and Mr. Morgan promises to see that they are not used in future. *Inga dulcis* seed was obtained and tried by some District Boards during the year. The result was not a success in Mainpuri, Garhwal and Kheri. Mr. Brownrigg, in his report for the Sultanpur district, gives an interesting account of this tree, which fully confirms the warning given about it in the last year's report:—

"The usefulness of this tree, more often used as a hedge tree, and better known as *nil kanta*, was brought to notice during the year. We have already tried it here. It is to be found at more than one place along the Fyzabad-Allahabad road. It is not a strong, though a hardy, tree and soon gets to look ragged and untidy. It suffered much from the dry season of 1896. Its pods are, no doubt, very useful for food, but it affords very little shade and is scarcely the sort of plant to be put down for avenue purposes."

"This is true. The tree is essentially a hedge-row plant, and is useful for planting up odd patches of waste ground: as an avenue tree for broad and wind-swept roads, it is not at all suitable."

"The advantage of planting *gular* (*Ficus glomerata*) trees on roadsides was strongly advocated by Mr. Phillips in his

'annual report of the public gardens at Allahabad for 1896-97. He even went so far as to consider that the *gular* should displace the mango on certain roads. Mr. Gollan, Superintendent of the Saharanpur Garden, who was consulted on the value of the *gular* as a roadside tree, remarks :—

"I consider the tree a good shade tree for planting in districts possessing sandy soils. The fruit, I believe, is eaten in all its stages by very poor people, but the idea that the *gular* should displace mango in provincial arboricultural operations is, in my opinion, absurd."

"I quite agree with Mr. Gollan's views. The people are sufficiently acquainted with whatever merits the *gular* possesses, but it can never oust the mango. It might, however, be profitably employed in place of the shadeless and fruitless trees that one often sees on roadsides."

We are glad to see that Mr. Meston endorses Mr. Gollan's sensible advice as to the mango, for we believe that the mango and *jáman* are the best of all trees for avenues, and they are closely followed by the *nim*. The *Inga dulcis* is not so bad as it is painted, if only a little trouble is taken to educate it by *real* and careful pruning. The *siris* we look upon as one of the worst trees to plant, as also is the *tún*, whose roots are surface-feeders. Space does not allow us, however, to discuss the best kinds for planting; for, after all, it is more a question of soil and climate than anything else.

The much discussed question of 'protection' is decided in favour of Cactus or thorns. In our opinion, good dry thorns are the best when procurable: in some districts it might be dangerous to grow Cactus for fear of its spreading to the adjoining cultivated lands.

The question of 'irrigation' is also discussed in the Report, and the advice of one officer is to plant a couple of plantain trees near each sapling 'as they help to keep the soil moist.' Unfortunately, it is just where plantains will grow that the soil is moist enough to make artificial watering unnecessary; where it is dry the plantains themselves would not succeed without water. In our opinion, more young trees are lost by too much, than by too little watering, and it is often forgotten that watering always makes a sapling delicate, causes it to keep its roots near the surface, and makes it liable to succumb when considered old enough to go without. In our opinion, if the plants are strong and healthy, and are really properly planted in suitably dug ground, they ought to be able to do without regular watering. And we think that it is often forgotten what excellent results can be obtained by 'sowing' instead of using transplants, especially with large seeds like those of the mango, which germinate easily and grow readily alone, and are the stronger for never having been moved. The *jáman* is another tree with a big seed that can be sown *in situ*. Then, again, there is 'basket-planting,' the very thing for avenue trees, but we have never heard of

of its being adopted. Then, again, there is propagation by cuttings, very useful for the figs and for some other trees, if there is a fairly good soil. It can be used for *jhingan* (*Odina Wodier*) and *Kharpat* (*Garuga pinnata*), both capable of being handsome trees, but unfortunately leafless in the hot season.

To conclude, in our opinion, the Report before us shows pretty conclusively that the failure of the work of avenue-growing and tending, if indeed it is a failure from any but a financial point of view, is due to the usual idea that the work is simple and can be easily carried out by the ordinary Collector and his usual native staff, without much, if any, technical training. It is, quite fallaciously, supposed that anybody can plant a tree, but that is a great mistake, and it is a still greater mistake to suppose that anybody can prune a tree (the Report does not mention *pruning* but it does *lopping*, and it certainly, in this, used what is a more accurate word to describe the operation usually carried out), for pruning is a delicate and difficult operation, not so much in the actual work of cutting properly, but in the choice of what to cut. How far the Cawnpore Agricultural School is capable of teaching just that little amount of technical knowledge required to enable a Tahsildar to correctly and properly supervise the planting and tending of his avenues, and the establishment of the groves and wells, which we are glad to see advocated, we are unaware; but in its own small way this subject points to what we mentioned before, the need of a general training college of for the Provincial Civil Service on the lines of the colleges Burki and Dehra Dún, and the desirability that in that college elementary arboriculture should find a small place.

J. S. G.

Jeypore Forest Administration Report for 1896.

This was received here in August 1897, and mislaid. Though late, it is, perhaps, not too late for remark. The area of forest is 1,80,881 acres, of which 4,60,506 are "Forest Reserves" and the rest "State Forest." This area is not sufficient to meet the wants of the people, and the misuse of cowdung as fuel instead of as manure, is rightly condemned. The local Tahsildars as yet do not recognise the necessity of Forest conservancy, and proposals for the extension of forest areas are vehemently opposed by them. Conflicting Departmental interests greatly impede the work of the Department. Forest administration is not regarded by public officers as an integral part of the whole Civil administration of the

State. Nevertheless, they have a way of repressing forest offences that would make the hair of most of us stand on end. "The Umri hill case is on the eve of decision by the Durbar, the villages of the Thakur of Bugru which encroached on it having been confiscated." This is delicious, a few villages being confiscated as a foretaste of the judgment to come, still there is a breezy virility about it that is refreshing. On the other hand, the case of Khorar has been decided by the Revenue Department, regardless of forest interests, in favour of the *Ijardar*, who has become entitled to all the sanding growth of the waste area of the village. Not having the pleasure of numbering the *Ijardar* among our friends, we are unable to state whether his rights were greater or less than the forest interests opposing them, and can only hope that substantial justice was done.

Under the head of Surveys there is nothing recorded, because there was nothing to record; "owing to the non-permanency of the Forest reserves, expenditure under this head is far from necessary." This ought to be remedied. The Madhopur-Chambal railway, sanctioned by the Durbar, will increase the demand for forest produce, and raise prices.

The forest offences were 448, of which 404 were petty thefts, 30 grazing trespass, and 14 various. Besides these, there were 30 convictions and 15 acquittals (together affecting 74 accused) under the ordinary laws. All these figures seem healthy enough, but an average fine of 5 annas per offender seems very low. Compounding is in force, 425 cases for Rs. 944, or an average of Rs. 1-4-6 per offender, which seems much more reasonable. There were no fires reported, though 1,11,306 acres were protected. Evidently, in Jeypur, the grass is too precious to be wasted in jungle fires.

Cattle trespass resulted in 3,139 sheep and goats, and 593 various being impounded, in addition to 137 warned off. The closed area was 59,000 acres, entirely closed to all browsing animals, 13,000 acres closed entirely, and 30,000 acres closed to cattle for part of the year. Which part is not stated, but presumably it would be for the two months of the so-called rains.

The natural reproduction of *Butea frondosa* and *Diospyros melanoxylon* was satisfactory, but owing to short rainfall the nurseries were in difficulties. Some Australian gum trees did well and attained 10 ft. in height. An experiment was made in propagating lac on *chilla* (?) trees, and was nearly a success, but the shikar officers prevailed with the Durbar and got all the lac-bearing twigs broken off, on the ground that game would no longer find shelter in the forests. Experiments with opium were made in total disregard of the feelings of Exeter Hall, and some useful and interesting results reached. Exeter Hall, however, found some allies who were deficient neither in sense nor in practical knowledge, viz., the

parrots and porcupines. Possibly they were unintentionally allied to the excellent institution for minding other people's business, for it appears that they eat poppies, if not opium. Porcupines eat the leading shoots. Parrots are charged with breaking off the finest flowers. As slings were freely used to keep them out of the crops, it may be difficult to decide whether the parrots or the guardians did the more damage.

The outturn of major produce was about 1,000 c-ft. of timber all used on Raj service, and 732.133 c-ft. (stacked ?) of fuel. Of the latter, 87,000 mds. were consumed by the Prime Minister. The equation of maunds and cubic feet is not stated, but it is evident that the general public demand is not yet great. The fuel is *babul* and *khijra*, and the coppice shoots are 2-3 ft. and 2-4 ft. respectively. The fellings are all unclassified and there are no working plans, but, nevertheless, a certain amount of order, and of fencing, has been introduced. Grazing is limited to about 3,700 paying cattle, and 32,000 paying goats and sheep, the settlement privileged animals being 2,500 more, while about 3,15,000 were admitted by special grace. It is thus seen that while settlement rights are frequent, they are always small, and concessions made, though generously given, are kept carefully distinct as personal favours. The revenue of the year was Rs. 29,568, and the surplus Rs. 17,044. The establishment consisted of 1 Superintendent, 6 Foresters, 4 Jamadars, 15 Clerks or Moharrirs, 50 Forest Guards, 1 Farash and 2 Chaprassies. Only one is, trained, and he is unfortunately nearly, blind.

Jodhpur Forest Administration Report for 1896-97-98.

We must apologise for the lateness of this Review, the Reports having been for a long time mislaid, and we will begin with the earlier of the two. The area treated of comprises 1,74,720 acres of Khalsa forests, 1,300 acres of village fuel and fodder reserves, and 17,700 acres of *jagir* forests. Though there were no Working Plans, a beginning was made by taking the Settlement maps and adding to them all the main ridges and ravines. A plan of operations (a very different thing from a working plan) was also prepared, no doubt, on the British-Indian model. The criminal tribes behaved well except some Meenas, whereas the Grassias have not improved a bit. The cases taken to Court were few, while those compounded amount to 269, affecting 416 persons, who paid about Re. 1 per head.

The forests were closed to browsers entirely, but horned cattle were allowed to graze from 1st April to 10th July, and again from 1st November to the end of the year. There was a

bumper crop of grass outside the forest, and a good supply within, which was not much needed. Certain restrictions were enforced to induce right-holders to cut and stack grass during October and November with partial success. Something of the sort in British territory would be by no means amiss. Right-holders were to cut grass from 6th October to 15th November, and non-cultivators from 1st to 15th November, free of cost, but after those dates they had to pay for it. One object of this is to ensure that the right-holders have some grass stacked if scarcity sets in. Another object is to stop grass cutting, and consequently, fires in the hot weather.

The number of cattle grazed is about 20,000, all but about 500 belonging to right-holders. The impoundings ran up to 4,000. There were 11 forest fires, burning 1,600 acres, a considerable increase due to the long drought. A *Grassia* with his pipe lit one and offered Rs. 30 as compensation. It was refused and he got 6 lashes instead. Natural regeneration was poor owing to a break in the rains. "There is no doubt" that "it is better where there is no grazing at all," and the closure during the rainy season "has immensely improved the natural reproduction * * * and there are signs of this improvement in all the forests except near the *Grassia* villages, where sheep and goats still graze." Compare the statement, made elsewhere, that 30 years' forest work has produced no visible result, on land no worse, and in a climate less severe be it noted, than those of Marwar! "There are lots of hillocks scattered over Marwar, which have no vegetation, and the villagers are of opinion that trees can never grow there," but "in the Giri forest, which was denuded of vegetation, it has been observed that the shrubs which were flush with the ground, owing to constant grazing by sheep and goats, have come up wonderfully within two years only." But then these native rulers have a way of enforcing obedience, or in the alternative cancelling rules that are untenable. A good deal of work was done in artificial regeneration, but the labour was mostly lost through failure of rain. The yield was 68,000 c-ft. of timber and 5,30,080 c-ft. of fuel, together with minor produce worth Rs 11,000, amounting to a total of Rs. 23,333, the surplus being Rs. 3,175.

In 1895, an experiment was started with village fuel and fodder reserves. Land was selected in two cases, but the villagers objecting were ordered to select lands to suit themselves. They selected two plots of 60 and 40 acres, which were demarcated and sown with seed of *babul* and *Khakra* (*B. frondosa*) and the results are encouraging. The villagers were told to remove the grass, but as they had plenty, it was sold to outsiders. During the year under report other 2,800 *bighas* in 4 villages were added; they were sown and planted. So far the results are very good and promising, even in

salt soil. Forest Rangers Rakhesbur, Gokal Chand, Daulat Ram and Lala Jagannath receive mention, and Mali Chatur Bhuj passed out from the Forest School with distinction.

The Report for 1897-98 now calls for remarks. The features of the year are the progress made with village forests and the failure of the lac experiments, through frost killing off the shoots on which they had established themselves, and through their indisposition to swarm abroad as they should. It was found that the scheme of plotting the ridges and ravines on to existing maps was very slow. It was, therefore, decided to begin at once a series of surveys on the 4" scale, and during the year a good deal of this was done by the Rangers. There is no local market for fuel and people are accustomed only to the permit system. Nevertheless, a beginning was made with Working Plans in the Desuri forest. The lower portions being *A. pendula*, will be worked as coppice with standards on a rotation of 20 years. The upper portions being chiefly *salar* (*B. serrata*) and bamboos, will be worked on the Selection system with the same rotation. It will be interesting to learn the number of standards reserved and the scheme of selection, and the results, when any shall be distinguishable. In Raipur Manjholi, a compartment of 880 acres was also laid out as coppice with standards on the same rotation. As the forests are burdened with rights, not more than one-fourth of the area will be closed at one time. For the other forests, plans of operations only have been prepared. As they are burdened with grazing rights and inhabited by criminal tribes, "sale of green wood will only be allowed where grazing can be controlled." The precise meaning of this is not clear.

The *Minas*, some of the wild tribes have become more amenable, but the others "do not care a bit for Rules and Regulations." There were about 20 prosecutions and 263 cases compounded for about Rs. 1-4-3 per head. In order to make the Grassias more amenable, the revenue work of their villages has been handed over to the Forest Department, which is a wise step. The arrangements as to grass cutting and storing, begun last year, were continued. In contending with fires, there is a standing complaint that the forest officials of Sirohi and Mirpur Jura fail to co-operate in any way and that their forests are a serious danger. The Postal Department has very considerably ordered the use of lamps, instead of torches, by dāk runners in the Behra forest. Compensation to the extent of Rs. 35 was taken for two fires, as the guilty parties were only careless and did not attempt to escape.

"The year under report was favourable for natural reproduction on account of the timely rains. Areas inaccessible to cattle are, of course, the best; but, even where grazing is allowed, the results are satisfactory. Protection against fires, and the total absence of camels, sheep and goats all the year

'round, and that of all kinds of cattle during the rainy season, 'have vastly improved the forests." As there was no demand for fuel no area was coppiced in any of the *Khalsa* forests, though others were worked. The coppice shoots of previous years have done well; *Khair*, *siris*, and *A. pendula*, for instance, making 6 ft. shoots in one year, and 15-20 ft. shoots in seven years.

Artificial reproduction met with varying success; the rains were favourable, but great damage was done by locusts, and *dhák* seedlings were killed by frost. Bamboos in some places are doing well.

Out of the total timber yield of 79,785 c-ft., no less than 34,624 c-ft. were removed by right-holders (30,298 c-ft. entirely free of charge). Out of the total fuel yield of 3,84,851 c-ft., no less than 2,66,060 c-ft. went to right-holders. In paragraph 63, the figures 6,71,615 are apparently erroneous, and should probably be 77,615. Minor produce was worth Rs. 10,995, and seven-tenths went to right-holders. The system of village forests was extended by 6,209 *highas*, so the total area at the close of the year amounted to 2,483 acres. The results so far are favourable, but the cavalry stationed at Nayagaon let their horses loose in the plantation there and spoiled 3,000 seedlings. The actual revenue of the year was Rs. 23,915, with a surplus of Rs. 3,481, but if the value given away to right-holders were included, the net surplus would amount to Rs. 20,000. Paragraph 123 is not intelligible to outsiders. "With the exception of two Jamiat Sowars of Kót all the rest remained absent during the greater part of the year under report, and consequently mercenary sowars had to be employed. After a good deal of correspondence it has been ordered by the *Ijlas* that the sowars for duty with the Forest Department, be supplied from different *Hakumats*, but none have come up to the time of writing." The staff before mentioned, again obtains commendation for having done a deal of good work.

V.-SHIKAR, TRAVEL, ETC.

How not to shoot a Panther.

It will probably be found to be the experience of every man who has done much shooting, that the disappointments he has sustained have been far more numerous than the successes. Men are, however, not generally eager to rush into print with accounts of their failures, which is the reason why nearly all the shikar stories that we read in papers and magazines, record the eventual satisfactory bagging of the game, either after good luck or successful skill and strategy. And yet it often occurs that there has happened more of interest on the occasions when one failed, than when one succeeded. It is for this reason that I propose now to give an account of a week's bad luck

and ill success, which was, nevertheless, full of incident though conducive at the time to excessive exasperation. To begin with, I must say that we were two guns; P. a recruit from Cooper's Hill, lately arrived and attached to me to learn his work, and myself. P is a good small game shot, but of course, had had no experience with big game. He was armed with a Paradox gun, with which he had made good shooting at marks, but the shooting capabilities of which he has yet to thoroughly understand. He was keen to shoot a panther and I naturally wished to give him the chance. We were camped at Galaor, a country of hills, any one of which might hold a panther. In days gone by, tigers were also to be had there, but there are none heard of now. Our *modus operandi* was to post Bhils in commanding positions along the hills, who, as soon as it got light in the morning, would keep a vigilant look out for panthers coming home from their night rambles. A panther having thus been more or less accurately located, word would be sent to us and we would go out and beat. The first day after our arrival in camp word was brought of a female panther with two small cubs being in a hole on a steep hill-side. *Muchans* had been made in trees just below and a live goat was tied up, and we then "sat up" in the afternoon in the hopes that the bleating of the goat would induce the beast to show herself. After two hours of ineffectual watching, men came up and told us they had just marked another panther down in a wide ravine on the other side of the hill. We went off at once to beat for it, and having posted P on a tree in a likely spot for the beast to come out, I went myself to the top of the steep hill slope on one side, where the beast was likely to break out, if he did not go straight down the ravine. Soon after the beat began the beast was seen moving a long way below me, and a few minutes afterwards I heard a couple of sharp reports from P's direction. Hurrying back a few paces, I saw the panther galloping off, about 300 yards from me, at the foot of the hill, and traced him into some high grass, where he disappeared. I then went down to join P and found that the beast had broken to his right, about 60 yards off, and that he had missed it with both barrels, though he had quite thought to have hit it, but found himself hampered by being on the tree. A consultation was held, but it was found that the beast had gone clean away and nothing more could be done. We went back to the same place next day and were presently told that a panther had again been seen to go into the same ravine that morning, and that, in fact, there were a male and female pairing and they had been seen together that morning. We had the same beat as on the day before, only this time I kept lower down the hill face, so that we both commanded the outlet of the ravine. I am doubtful if there really was a panther in the ravine. The men said there was and

that the animal broke back and went out at the "neck" of the ravine soon after the beat began. Of that I had my doubts, but what did happen was, that soon after the beat began, a tremendous hullabaloo from the watchers on another hill slope *behind* me, made me turn round on my tree, in time to see a panther charging down the hill a quarter of a mile away. It was then that our beaters came through with the tale of their beast having given them the slip. The new panther had evidently stayed in the *nallah* at the foot of the hill, since he had not been seen to climb any other hill slope, all of which were sufficiently open for an animal to be easily seen. We hurriedly took up new positions at the head of the *nallah* for a new beat. P was on a *babul* tree on one side of the *nallah* and I on a *bèr* tree (*zizyphus jujuba*) on the other side. There was a high dense bush on my left; but this did not concern me, as I expected the beast, if he came at all, to come up the sandy *nallah* bed, which I accordingly faced. I knew the beat would be a short one and accordingly I was on the *qui vive* the moment the shouting begun. The first shouts had hardly died away when I heard the faintest rustling in the grass behind me. There being no wind at the moment, the noise made me suspicious and I turned by head quickly, just in time to see a fine panther bounding along, fifteen feet from the foot of my tree. I brought my rifle round sharply, but before I could get it to my shoulder the beast was out of sight behind a bush, and not a trace of him did I see again. He had evidently been lying up in the long grass not far from my tree, and had come along the path behind the bush on my left so stealthily, that I could not see him or hear him till the longer grass rustled against his side. This was ill luck with a vengeance. The beast had absolutely given himself away to me, but I had seen him a few seconds too late. Hastily getting the men together, we climbed up the hill to cut him off, in case he had stayed on the way, and the beat came through to us, but the panther had gone on and we saw him no more.

As the panther with the cubs might still be lying around, in spite of the noise we had made in beating, my wife said she would like to sit up for a couple of hours that evening as there was a good moon. Accordingly, we had the ponies saddled and went out to the place about 6 p. m. and sat up in the *machan* till 8-30 p. m., with a goat below us, who lamented his woes in a satisfactory manner for some time. No panther appeared, however, though after the goat had got quiet, a fine boar came and stayed some time eating roots and *babul* pods.

We had not yet finished with our ill luck, however. The next day was Sunday, generally a lucky day for shikar with me. *Khubber* was brought to us in the afternoon of a panther having been traced into the hill-side on the top of which is the

fine old fort of Galna. We went out at once ; P was posted a little way up the hill and I below the scarp and the beat began. No panther came out, but numbers of peafowls came all round our trees giving most tempting shots, and all the more tantalizingly so, that my wife had been urging us to shoot a peafowl to afford a change in the ordinary camp fare. I had made up my mind that, if towards the end of the next beat no panther had come out, and peafowl did, I would shoot one, and I got ready my shot gun accordingly. We then went off to get further round the hill for the next beat. This took us some time and we were so doubtful about there being a panther on the hill at all that I am afraid we went rather leisurely. However that might be, I ought to have remembered that, when Rhils are conducting a beat, they are very prone to begin too quickly. When we got to the places the men wanted us to stay at, there was some difficulty in finding a suitable tree for P. Having seen him finally settled and got hold of my spare cartridges, the man carrying which had lagged behind, I went higher up the hill to the second place and got on to my tree. This was a low and very awkward one, and I was arranging how I could settle myself to the best advantage, so that I could seize either shot gun or rifle, as might be required, when I suddenly heard the shouts of the beaters and at the same time saw the face of the man who was with me, freeze with a look of di-may. I looked hastily in the direction of his gaze, and there was the panther, galloping straight along the path which passed under my tree. As it happened it was the shot gun which I had in my hand at the moment ; and the more I waved my hand for the man to pass me the rifle in exchange, the less ability he appeared to have to move a muscle. At last I shouted to him and managed to get the rifle, the panther having by this time already passed my tree. Hastily cocking one hummer I brought the gun to my shoulder, only to find a branch in my way. I sighted afresh on the panther, just as he was disappearing, and pulled the trigger, but too late. The bullet hit the ground where he had been, and the panther was off. To say I shook my fist in the face of the native who refused me my rifle, is to relate only one tithe of the way in which my indignation and rage at him, and my self too, showed itself. The whole occurrence was too humiliating altogether, and one's *amour propre* could not stand two such shocks as this and that of the preceding day, however much one might, on cool reasoning, persuade oneself that really one was not much to blame in the matter, and that the two occurrences were sheer ill luck. I went down to P and found that he had seen the panther, which had passed in front of him at a gallop, ten yards off, but, seeing that it must go under my tree, he had naturally not fired. The beat had evidently begun much too soon and the panther had been started at once. Subsequent reflection made me think that

matters might have been considerably worse, as, if the beast had come along the path before my gun bearer and I were on the tree, it might have taken an unpleasantly good shot to keep him off one or other of us.

But the matter had not ended yet. We found out that a man on the fort walls on the top of the hill had been able to keep the panther in sight, and so could tell us that he had not yet left the hill. We, therefore, hurried round the hill to where a small ridge connected it with another smaller hill. A small, broken-down stone wall extended across the passage, part of the old fortifications, and to guard this I left P posted on a tree, whilst I went up the hill-side myself, thinking the panther might come along under the scarp below the fort wall, as was quite probable. The beat began again, and soon a yell from the top of the hill announced that the panther was on the move. Presently he came to the *nallah* dividing the two hills, evidently with the intention of crossing over and getting away round the smaller hill. Men immediately ran to head him off, and by dint of much shouting succeeded in doing this; and he went back into the *nallah* and lay up in a dense thicket of Euphorbia and shrubs. Here the beast sulked and was evidently most loth to come any nearer. The *nallah* led directly up to where P was posted, and I saw that, if the panther could only be moved, it was bound to come to him. I therefore moved a little down the hill and stood on an overhanging scarp, about 50 yards above P, so that I might, if necessary, get in a shot after him. It was rapidly getting dusk, and it was evident that, if we did not soon get the panther to move, we should have to leave him. The shouting, therefore, redoubled, and presently we heard yells that he had broken cover. Then I saw him heading up the path-way at a gallop, right in front of P's tree. A shot from him knocked the panther over, and I lost sight of him; but he was up again in a moment, gave three growls and then bounded over the wall, and was hidden again in brush wood before I could sight on him. I went down to P and found he had been unable to fire his second barrel owing to his position on the tree, but there was no mistake about the first having hit, though no blood could be found. It was too dark now for any thing more to be done, and so we returned to camp. On Monday morning we started off to try and track the beast and soon came across a spot where he had evidently lain up, and where blood had soaked into the ground. We followed his pugs for a short distance more and then lost all trace, and we had to give up the pursuit. Subsequently however, pugs were found on a path leading out of the hill forest and it became clear that the animal could not have been hard hit, and that he had gone clean away in the night.

We stayed a few days more at the camp, but had no more *khubber* either of this panther or of any other, and thus realized the truth of the old adage that:

“He who will not when he may,
When he will, they’ll say him nay.”

G. P. M.

VI.—EXTRACTS, NOTES AND QUERIES.

Forestry in the United States.

The report of the Executive Committee of the American Forestry Association, read at the seventeenth annual meeting, and recorded in their magazine, ‘The Forester,’ contains the following interesting account of marked progress.

The most important work of your Committee during the past year has been its contribution to the successful endeavor to ward off the threatened attack upon the forest reserves set apart by President Cleveland, which had been suspended for one year prior to March 1, 1898. In the last Sundry Civil Bill the Senate inserted a proviso suspending the President’s order setting apart these reserves, and restoring them to the public domain. Your Committee, on April 2, decided to take action and sent out circular letters to all members of the Association urging immediate protest. On April 13, a memorial was sent to all members of Congress, urging that the Senate amendment, if adopted, be limited to one year. Still later, specific amendments to the Sundry Civil Bill were suggested to the committees of the House and Senate. The efforts of this Association were in line with, and were assisted by those of officials and private individuals, and the combined protest had its effect. The House refused to agree to the Senate amendment, and the reservations were saved.

During the past year, there were submitted to the Association some eighty-nine designs for a corporate seal. A competent jury of well-known artists and architects passed upon these designs, and decided that no one of them was possessed of sufficient merit to warrant your Committee in paying the prize of \$100 offered to the successful competitor. The designs were exhibited at the Cosmos Club in this city, and surprise was expressed that they should have been so unsatisfactory.

In June last the Association met with a loss in the resignation of Dr. B. E. Fernow as Chairman of the Executive Committee and Editor-in-Chief of *THE FORESTER*. His peculiar fitness for the position, his ability, his jealousy of the rights of this Association, and his untiring and aggressive enthusiasm for the work, have been of very

great value to the Association, and have contributed in no small degree to the progress it has made and the influence it has wielded. The retirement of Dr. Fernow, to take charge of the New York State College of Forestry at Cornell, is regretted by none more than those who have been so long associated with him in the work of the Executive Committee.

The progress of forestry in the United States, during the year which is about to end, has been most satisfactory. Public sentiment throughout the West, which, soon after the proclamation of the Cleveland Forest Reserves, was in an attitude of bitter opposition, has continued the remarkable change begun during the year which followed the proclamations, and at present opposition has practically died out. The only conspicuous exception is in the State of Washington, where the Republican platform contained a clause asking for a restoration to the public domain of all those portions of the forest reserves valuable for agriculture, mining or timber. In the Black Hills, where the protest was perhaps more vigorous than elsewhere, it has been replaced by the most cordial feeling, so that the Black Hills Forest Reserve has been increased by nearly half a million acres with the full assent and co-operation both of the local population and of their representatives in Congress.

Four new forest reserves have been created since the eleven suspended reserves emerged from that condition on the first of last March. These are the Pine Mountain and Zaca Lake Reserve in Southern California, of 1,644,594 acres, the Prescott Forest Reserve of 10,240 acres, the Black Mesa Reserve of 1,658,880 acres, and the San Francisco Mountains Forest Reserve, of 975,860 acres, all in Arizona. In addition, the boundaries of the Pecos River Reserves in New Mexico, have been changed and enlarged to embrace 120,000 acres more, and those of the Black Hills Reserve have been similarly changed, with an estimated increase of 433,440 acres, a decrease of 189,440 and a final total of 1,211,680 acres.

The care and protection of the forest reserves has been entrusted to the General Land Office. For that purpose an appropriation of \$175,000 was made by the last session of Congress, and during the summer the work of organizing a forest force has been begun.

The report of Mr. Frederick V. Coville, Botanist of the Department of Agriculture, on Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon, brought the question of forest grazing to public attention in a thoroughly scientific and practical manner for the first time. No other single factor has contributed so much toward a settlement of this most important question. The approval of Mr. Coville's plan by the sheep men was instant and widespread.

The foundations of the New York State College of Forestry, with Dr. Fernow as Professor of Forestry and Dean of the Faculty, and Mr. Roth as his assistant, is the most notable step yet taken in forest education in the United States. The last available report gives the names of 39 students of Cornell University, who are participating in the courses of the school.

During the year another forest school, on simpler lines, was begun at Baltimore, in North Carolina, under the direction of Dr. C. A. Schenck. Four students are in attendance on the thoroughly practical

courses of the school. The mapping and description of the forest reserves, under the direction of Mr. Henry Gannett, of the U. S. Geological Survey, has proceeded very satisfactorily during the past year. Nineteen reserves have so far been examined, and statistics of standing timber have been collected for Washington, Northern Idaho and part of Oregon. The Association is particularly to be congratulated on the prospect of possessing, in the near future and for the first time, reliable statistical statements of forest resources in some of the most interesting portions of the country.

The resignation of Dr. Fernow from the Division of Forestry was followed by the appointment of Gifford Pinchot as Forester of the Department of Agriculture, and by the reorganization of the work of the Division. The attention of the Division is to be directed hereafter to field work as fully as the circumstances will permit. A Plan of the Division, outlined in Circular No 21, by which it undertakes to assist private owners in the care of their forest lands, has been responded to by applications for such assistance, which cover about 1,100,000 acres.

The action of the International Paper Company, in appointing Mr. Edward M. Griffith, a trained forester, to assist in the management of its timber lands, is a notable step forward in the progress of forestry, since this company is by far the largest producer of wood pulp in the United States. Mr. Austin Cary has been appointed by another company for a similar purpose.

The purchase of forest land by New York State, in the Adirondacks, under the appropriation of \$1,000,000, had resulted, at the last report of the Forest Reserve Board, in the expenditure of more than \$900,000 and the acquisition of over 25,000 acres at an average price of \$3.685 per acre. The school forest of the New York State College of Forestry, of about 80,000 acres in extent, has recently been added, only, however, as prospective State property, since it will belong to Cornell University for a term of years before reverting to the State. Pennsylvania has acquired 55,681 acres of wild lands as the result of an admirable plan for the creation of State forest parks at the head-waters of important streams, and the rebate provided by law in the taxes of timber lands is beginning to be widely claimed. Forestry Associations have been established in Utah and Massachusetts, and the latter has been exceedingly active in forwarding the good work.

One of the ends for which the Association has been striving for many years, namely, the establishment of a Government system of forest administration, having now been attained, the members of the Association can devote their energies to no more important object than the maintenance of a public interest, which shall insure efficiency in the administration of the forest reserves.

The Wisconsin Commission.

The report of the Wisconsin Commission appointed to inquire into the matter of better forestry legislation is reviewed in the *American Forester*, and we extract some of the sensible conclusion at which the Commission has arrived.

Fire protection.

"Without some effective system of fire protection there is no hope of placing the forest industries of the State upon a stable basis. It is clearly as much a duty of the public authorities to prevent forest fires as to prevent and extinguish fires in cities."

The relative advantages of public and private ownership of forests

"The conclusion is reached that the State must either allow its lumber, wood, and allied industries to decay, or take the supply of the necessary raw material into its own hands."

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

2nd February, 1899.

EAST INDIA TEAK.—The deliveries in January have been 2,340 loads against 2,497 loads in January last year. The stock is reducing quickly, and prices are very firm; retail rates having improved again in London since Christmas and holders of cargoes of teak afloat are feeling their position so strong as to make them unwilling sellers at present.

ROSEWOOD.—**EAST INDIA.**—Is of ready sale, if fairly good.

SATINWOOD.—**EAST INDIA.**—There is a fair stock with a moderate demand, principally for figury logs.

EBONY.—**EAST INDIA.**—Really good parcels would command fair prices.

PRICE CURRENT.

Indian Teak	per load	...	...	£ 11	to	£ 16
Rosewood	" ton	...	...	£ 5	to	£ 11
Satinwood	" sft.	...	...	9d.	to	2s.
Ebony	" ton	...	...	£ 6	to	£ 8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST FEBRUARY, 1899.

TRAK.—The landings in the docks in London last month consisted of 369 loads of logs, and 666 loads of planks and other scantling, against deliveries of 1,748 loads of logs and 546 loads of planks and scantling. The dock stocks at date analyse as follows :—

7,727 loads of logs, as against 10,579 loads at the same date last year.			
4,029	planks	2,944	
28	blocks	14	
<hr/>		<hr/>	
11,784 loads		13,537 loads.	

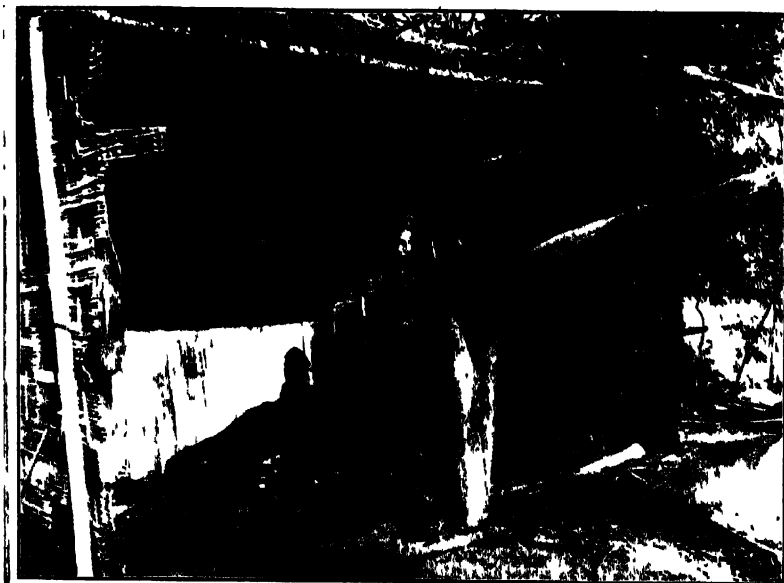
A delivery of some 2,800 loads is very satisfactory, and the prices obtained have been full ones as compared with those of last month, if not as compared with the present cost of shipment in Burmah and Siam. The prices now ruling in Siam will not permit of any extension of the existing commitments for log shipments to Europe from Bangkok, whatever may be the case in respect to planks or small scantling, and it is to be regretted that the useful Siamese competition with Burmah is thus curtailed, as any further increase in the shipping cost of teak will tend to restrict consumption.

Business during January lacked briskness in spot business, but prices were well maintained in all directions, and probably more forward contracts arranged than is usual in the first month of the year.

CORRIGENDA.

Indian Forester, January 1899.

- Page 7, last line at bottom read : here, Galti in Luckovalli
 " 8, 10 line from top " Helwank instead of Helwauk
 " 11, 15 " " below " Barmdeo " Basudeo
 " 12, 4 " " top " there " thus
 " 13, 17 " " below " Picea " Pinus
 " 14, 16 " " top " age " stage
 " 15, 10 " " below " mast " mark
 " 10, in footnote, read : but the district probably was
 Garhwal.
 " 17, 15 line from top read : In Burma I have found it in
 flower
 " 18, 2 " " " " The weight of the seed, and the...
 " 23, 16 " " below " for the buds of the flowers,
 instead of for the ends of the flowers.



CUTCH-BOILING IN BURMA.

THE INDIAN FORESTER.

Vol. XXV.]

April, 1899.

[No. 4.

Brandis Prize Fund.

Notwithstanding that notice is attracted to this Fund by an advertisement on the cover of each issue of the "Indian Forester," several years have passed without any good articles appearing from the pens of old students of the Dehra Dún Forest School. Consequently, awards have not been made. Passed students are requested to note that any original paper may gain a prize of Rs. 100.

Photographs of catch-boilers' camp.

For the accompanying photographs the Editor is indebted to the courtesy and artistic skill of the wife of a well-known Forest Officer in Burma. The scenes depicted represent a camp of Burmese workmen engaged in the manufacture of catch from the wood of *Acacia catechu*. In the upper photograph a log of catch wood is in process of conversion into chips, which are boiled in earthen vessels shown in the lower picture. The solution, obtained by boiling in these pots, undergoes further boiling in the evaporating pan shown in the photograph, until, on cooling, it attains the consistency necessary for the ordinary purposes of the market. The process is too well-known to need detailed explanation*; and though primitive and rude, it is sufficiently effective to produce catechu of very considerable value and to offer fair remuneration to the labourers engaged in the industry. Of late years, catch manufacture in Burma has greatly declined

* Full description of the method and statistics as to yield are recorded in the Dis. of Econ. Products.

owing to various causes attributable partly to temporary depletion of the forests, in many localities, of cutch trees of workable size, and in part also to alleged replacement of cutch by other substances, in some of the industries in which catechu was formerly chiefly in demand. Recently, however, the trade in Burma has shown signs of revival, and to ensure permanency of supply of this useful product, measures have been taken for preservation and reproduction of *Acacia catechu* by reserving the most productive cutch forests and by establishing plantations on a considerable scale.

Some remarks on forest concessions in Oudh and in general.

The Forest reserves in Oudh occupy the Northern portion of three districts on an area of 923 square miles. Outside these tracts, the production of timber fit for building purposes is insignificant and is, moreover, constantly decreasing with the spread of cultivated area. A population wholly engaged in agricultural pursuits, and as dense as in the most crowded European States, must therefore obtain its requirements from the Government Forests situated either in its own, or a neighbouring Province, but it is probable that the influx of timber from the North-Western Provinces, Nipal or Bengal is not in such quantity as to warrant consideration. Happily the provincial demand, imperative as it may be, is not exorbitant. Outside the towns and cities the peasantry are content to dwell in thatched huts of wattle and daub, or in roughly tiled residences with mud walls. Permanence of abode indicates the power of purchasing durable building material, and, therefore, comparative wealth; the absence of that affluence, accentuated by the scarcity of cheap wood, compels the construction of houses whose inferior material has no duration, and is, therefore, necessarily renewed almost annually. The poor quality of timber used in the majority of villages at a distance from the forest, is apparent to the most inexperienced observer, and the inference is that the supply of timber at prices within reach of the peasantry is insufficient, and that, in consequence, the cultivating classes suffer in not possessing weather-proof houses, and in the expense attendant on the constant necessity for repairs. It will be allowed that, especially in a country where extremes of cold, heat and

The importance to the country of a cheap timber supply.

damp are marked features of the climate, the people cannot be at their best, much less improve in physique, without adequate protection against climatic influences; even the peasant acknowledges this fact in his practical way by the construction, so soon as he can afford it, of a permanent and more commodious residence.

(2). We may next consider the position of Government in reference to forest management, and though the following remarks may not be subscribed to by all, yet it is possible that the opinions expressed may be more or less general. The outturn of a State forest is the property of the State, to be utilized for the benefit of the country in such a manner as the Government may consider to be most desirable; provided that the community as a whole profit, the method of utilization is theoretically immaterial. Amongst other ways it may be accomplished directly by providing an adequate supply of building material at a reasonable price, or indirectly by reduced taxation. In practice both these results may follow, the sale of the

On the responsibility of Government and of the Forest Officer.

more valuable timber will bring in revenue to the Government Treasury; the protection of less important woods will place material suitable for village requirements in abundance on the market. Again, the amount of the outturn is dependent, theoretically, on the work of the Forester; he can estimate the normal yearly increment and propose such arrangements as will bring the area under his charge to its full yield; but, in practice, he may be restricted in his work by local encumbrances, and prevented from utilizing for the production of timber a part, or even the whole, of the forest area. The Government of the country is thus responsible, not only for the proper utilization of the forest area, but also for prescribing the utilization of the outturn therefrom; the Forester is responsible that, so far as he is permitted to do so, the forest in his charge shall be in the highest state of efficiency.

(3.) The forests of Oudh are free from all rights of user; in them Government possesses an unembarrassed estate, in trust, not only for the present population but also for future generations. But there are certain paramount claims, which have to be considered, before the utilization of the forest area and of its yield can be decided on in detail. These claims are those of the villages which surround the forest or of their owners. In former days, the Settlement of these village areas was difficult owing to various untoward circumstances; the inroad of wild beasts on flocks or crops; the unhealthiness of the locality; the absence of all that makes peasant life enjoyable, such as good water, attractive shops and gay society; the isolation of these tracts, indeed, at that time often resulted in a mono-

The origin of Concessions.

tonous life of sickly toil. Low rentals and free forest produce were the inducements offered to tenantry to settle in the vicinity of the forest, but as the country became opened up by improved communications and by increase of population, the landlord increased his rentals and Government its demand, whilst the State forests remained burdened with the *onus* of supplying, to the direct benefit of the landlord, free grants for an ever expanding population. It is the history of the attempts to satisfy and define these claims that it is proposed to narrate; the story of how the balance has wavered between the demands of those nearest the forest, and, therefore, most readily able to utilize its products, and the rest of the community whose need is doubtless as urgent and their claims perhaps even more so; for they are infinitely more numerous and probably also infinitely more valuable to the State as representing *par excellence* that source of revenue, on which the stability of Imperial finance mainly depends. No criticism on the action of Government is here attempted or intended. A bare statement of facts which have occurred during the last 20 years is presented, and from them the reader, be he Forest or Revenue officer, can judge of the progress made in deciding what portion of the State forests and their yield, should be devoted to the benefit of the neighbouring villages, and what portion should be set aside in satisfaction of wider claims and more general interests.

(4) In 1879, or some 15 years after the establishment of a Forest Department, a committee, composed of a Revenue and a Forest Officer, was appointed to consider the question of privileges and concessions and to report thereon for the information of Government. The Revenue Officer visited the forests and submitted his report, able and painstaking, but marred by certain expressions of opinion raising questions, which had long passed the period of discussion, and were even then accepted as facts at definition. The Forest Officer submitted no report; he annotated a copy of his colleague's production and so lost both the opportunity of placing departmental views before Government and also of making proposals, which might have, once and for all, laid to rest the vexed question of concessions. In the circumstances it was inevitable that Government should accept the only proposals made, and the order issued that all villages within 3 miles of the forest should receive grazing at one-half the usual rates, free, unreserved timber for building and agricultural purposes, free grass for thatching and thorns for fencing; whilst the *Tharus*, a caste apart, in return for a specific service, viz: gratuitous aid in fire conservancy, were to receive free, dry *sal* wood for wells and bridges. Such, however, was the lack

of perception in the local Forest Department that the importance of defining the amount of produce was not grasped: in two of the three districts, the so-called 3-mile villages were listed; in the third no such record was ever completed, while it remained for the Revenue Officer to represent to Government the advisability of fixing the quantity of produce to be granted; and, when the necessity of such a proceeding was questioned, the Forest Officer failed to show any insistence. For subsequent trouble and labour the Department must, in a great measure, hold itself to blame.

(5) The incidence of the concessions thus granted 'was not at first oppressive to the forest, at least so far as the grant of timber and produce was concerned. These privileges were guarded by a clause which made it penal to sell or barter produce given for a specific purpose, and this rule afforded a check, not entirely efficient, but at any rate helpful in restraining inordinate demands by the villagers.

There is no doubt, however, that the free grants of produce did filter through the 3-mile villages to others outside the radius, but, whether these illicit transactions were carried out entirely by sales from the privileged villages, or by connivance with the forest staff, is not apparent. It may safely be surmised that both, villagers and staff, combined to make easy a proceeding so much to the benefit of all three parties. The concession which became, however, intolerable in its undefined enormity was that of grazing at half rates, and this without any restriction as to the number of cattle or to the agricultural requirements of the owners. In a few years' time an agricultural tenantry was supplemented by a pastoral community, which settled itself in the privileged villages, thus reaping all the advantages intended to assist in the spread of cultivation. Gradually their cattle over-ran, not only the State forests, but also the fields of their neighbours, who had thus more difficulty in protecting their crops from domestic cattle, than from the few wild beasts who still found standing room in the forest. A system was even introduced in one forest of turning large numbers of cattle loose and of only rounding up the herds yearly to collect the calves for sale; and in consequence damage done to cultivation within reach of the forest became insupportable to the tenantry who, such is sometimes the irony of circumstances, either made no advance in number, or actually decreased owing to unregulated generosity in conceding privileges; whilst the Forest Officer was reduced to despair at the spoliation of the forests. It may hardly be believed that up to 1898 it was in practice an accepted fact that there could be no satisfactory grazing without firing, that, the experience gained in other countries besides India proving that protection from fire results in killing

The effects of undefined concessions.

down the ranker grasses and favoring those more suitable for fodder purposes, should have been unknown or ignored. (In this connection the history of the vast cattle breeding grounds in South America may be found both interesting and instructive). But this will not be considered so surprising when, in the penultimate year of the century, we find a Revenue Officer in a most responsible position as regards forestry, stating publicly that fire-protection is, in hill forests, actually pernicious to the forest. Forestry is evidently a science which is permitted no axioms and whose elementary propositions may be disputed by those, who have no theoretical knowledge, and mistake the superficial observations of a few days or months for practical experience.

(6). The position in the Oudh Forests, resulting in undefined concessions and erroneous ideas in regard to the effects of protection, was shortly that produce, vastly in excess of the domestic requirements of the 3-mile villages, was yearly withdrawn from the reserves; whilst the area which could be worked as tree-forest was enormously reduced in order to supply grazing grounds for cattle breeding. The details of this industry are worthy of note and the inferences drawn may be checked from the reports of the Veterinary Department on Cattle breeds in India. The local breed of cattle had, in the past, obtained some

On cattle breeding and forestry. notoriety on account of its size and courage; the individuals composing the herds were valuable; the village waste lands were extensive, and the grass lands in the neighbouring forests afforded ample grazing during the summer months. Without over-crowding and with the care which the agriculturalist is able to afford the few animals in his charge, a good breed of cattle was created and maintained. The case became different when the concessions attracted large herds of cattle, either to settle permanently in the vicinity of the forest, or to pay annual visits from a distance. These animals were left to shift for themselves, no attempt was made to regulate their breeding, they died in hundreds from disease, hunger or exposure, whilst the best of the survivors were sold in their youth and owed what strength and vigor they attained to the personal care of their purchasers and to stall-feeding. The ruin of the forest brought no benefit to agriculture but rather the reverse, for home-reared cattle will always be superior to those only semi-domesticated, and forests, though they may be a helpful adjunct at that period of the year, when field fodder is scarce and labor is so plentiful as to permit of careful herding, are not indispensable to maintain the supply of cattle; if this were the case, it would fare ill with those Provinces, which possess no forest grazing grounds, and yet prove their independence by producing a breed of cattle much superior to any in the Province of Oudh.

(7). Up to this time no Working Plans existed to bring the forests under regular treatment, but the value of the forests and the necessity, in view of the constantly improved communications, of regulating the yield rendered it absolutely necessary to remedy this defect. But even before the first steps were taken in this direction, the Forest Officer was met by the impossibility of fixing the details of working or of estimating the outturn so long as the area for the supply of concessionists remained undefined. When these facts were represented, the responsibilities in the utilization of the forest areas, and of their yield, were recognized, and permissions accorded to the compilation of records of concessions, which were once more expected to settle, for ever, the questions which had been under discussion for so long. The importance of the subject necessitated that it should be approached with the greatest care, and a Forest Officer of the Provincial Service was put on special duty to examine the circumstances of each 3-mile village, to enumerate the houses and cattle, and to estimate the requirements of the people on the basis of cultivated area; in short, to collect all statistics bearing on the subject which might assist Government in arriving at a decision. The thoroughness and accuracy of this work was acknowledged by Government, who was thus enabled to fix the foundations on which the detailed superstructure of the record of concessions should be reared. The basis of this record was that in such villages, within a distance of 3 miles from the forest, as were selected for the continuance of enjoyment of privileges, cattle should be admitted to graze at half rates up to a maximum of 4 head for each 10 bighas under cultivation, provided that the area available for grazing outside valuable tree forest allowed of one acre per head of cattle being set aside for this purpose. If the area available were less, the cattle were decreased; if more, then surplus cattle could be grazed at full rates. Each cultivator also was entitled to receive for each 10 bighas under cultivation 30 c-ft. of unreserved wood annually or one-third that amount of *sdl*, on payment of one-third the market rates. One and a-half cart loads of thatching grass were also allotted on the same terms, whilst thorns and fuel were given free up to actual requirements. The decision to make these concessions on payment emanated from Government; it was considered that by placing a money value on the produce, wasteful utilization would be abruptly checked, whilst the departmental regulation of the concessions would perforce receive closer attention. It was, moreover, made penal to sell or barter produce which had been received for a special purpose at special rates. On these lines records for all three districts were prepared, and of these, two received sanction and came into force; whilst the introduction of the third was postponed until a grazing lease,

which for 20 years had burdened a portion of the reserves, had expired.

(8) The effects expected from these new rules may now be considered. In the first place the areas open to grazing were defined, and thus the Forest Officer knew

The effect of the second record, where felling operations might proceed and where they were not permissible; secondly, the maximum demand in unreserved and *sâl* timber, and in minor forest produce was known, and no further impediment, therefore, existed to the systematic working of the forests. Further, wasteful utilization was to be effectively checked by the imposition of a small royalty, whilst the prohibition of sales of forest produce granted for agricultural purposes tended to act as a further deterrent on indents for amounts in excess of actual requirements. The introduction of the new records caused some dismay amongst the tenantry, more amongst the cattle breeders, and perhaps most amongst the landlords, who emphatically opposed it. They probably anticipated not being able to ask such rents as in the past, for the reason that they could no longer guarantee to their tenants such full use of State reserves as in former years; they foresaw that they might be obliged to grant, from their own waste lands and forests, a supply of grazing and produce which they had hitherto obtained from outside; the cattle breeders, too, recognized that the grazing in the forests would in future be held primarily for those occupied in cultivation: whilst the tenants were annoyed at the restrictions imposed and were doubtful if the landlords would prove as generous with their wood-lands as they had been with those of the State. For the first year of working, misapprehension and the dullness of the Hindustani of the lower classes in grasping any novel regulation, effectively backed by the stocks of free timber in hand and the assistance temporarily afforded by the landlord in facilitating grazing in private lands, enabled the people to prove their independence of the State forests; but in the following year they commenced to enter into the new order of things, and demands for timber and grazing recommenced. What the ultimate result would have been; whether in a short time the tenantry would have valued and exercised their privileges, or, on the other hand, considering them worthless would, like many millions of other cultivators, have found it possible to do without them, it is impossible to say. These questions may be left to be answered by those qualified to do so, for this is a history and not a prophecy; but, while the statistical statement appended will enable a comprehensive view of the situation to be taken, the records of 1894-95 and 1895-96 did not survive long enough to enable a narrative of their working to be recorded.

(9) In 1898 Government, considering that the existing arrangements for utilizing the State forests in Oudh might not be entirely desirable, referred the question to the Revenue Officials and supplemented their reports by a visit to the forests in one district. In result the existing records were deemed to be unsatisfactory and the compilation of others on a new basis was ordered. The alterations

The third attempt at definition. in the system now considered necessary were based on the opinion that the villagers in the vicinity of the forest had not received sufficient consideration; that the utilization of the State reserves should be primarily for the benefit of those whose residences may be in the immediate neighbourhood; and on this basis the following orders were issued. That the tenantry in the villages on the privileged list should receive grazing at half rates for all the cattle they owned up to the maximum area available, without encroaching on valuable tree forest; that they should receive free, and without restriction as to sale or barter, 20 c-ft. of unreserved timber in poles, or 30 c-ft. in large timber, or one-third that amount of sâl for every 10 bighas under cultivation; and on the same terms two cart-loads of grass, and fuel and thorns free to an unlimited extent. A census of cattle and houses was to be taken and the details of the record was to be worked out thereon.

(10) The important changes in this recognition of the claims of villagers in the neighbourhood of the forest was thus two-fold: *First*—The number of privileged cattle were not restricted to the purely agricultural requirements of the people. The grant of the grazing privilege depended on chance, on the number of cattle which happened at the time of the census to stand within the limits of any individual village, without reference to the uses to which these cattle were put. Where, however, the grazing areas are insufficient to support the entire number of cattle present in the villages, the allotment of privileged cattle by villagers is to be made by the Revenue Officer, and in such cases the agriculturalists should, in theory, have the advantage over his neighbour engaged in trade. Whether he will do so in practice may sometimes depend on the Patwari. *Secondly*—The grant of produce, though based on the agricultural requirements of the people, was not limited to these requirements; the grant in the first record was unlimited; in the second it was 30 per cent in excess of the estimated actual requirements; but this generosity was intentional on the part of Government in order to minimize any possible hardship in the rule, that the produce considered necessary for a specific purpose, should only be utilized for that purpose. In the third record the utilization of the grant is undefined; it has a money value and is negotiable and, therefore, certain

to be availed of in full. In the second record, two-thirds of the grant might be taken as the maximum demand, probably much less ; in the third, the whole grant must be taken as the probable demand. It is impossible to compare the incidence of the concessions under the second and third records ; the latter have not yet been completed even in the one district for which Government orders issued in 1898. The collection of data is a slow process, and it is yet unknown what will be the maximum demand in produce ; but, so far as it is possible to do so, the figures have been worked out in the appendix to these notes ; but they are of no value unless it is remembered that the grant of 1898 is absolute, and that of 1894 conditional.

(11). It may be the opinion of some that, the settlement of forest concessions might be as readily completed as the settlement of the incidence of land revenue, and that a revision of the record once in 20 or 30 years would here also meet the necessities of the case ; but the facts narrated in the preceding paragraphs tend to show that the settlement of privileges may take some 80 years to complete, and may require revision in as many months. In Oudh, at this moment, finality is as far distant as before 1879, and the experience of the past does not justify the hope of its speedy attainment. The necessity for the definition of concessions is admitted, but the terms on which these should be granted, the requirements on which the privileges should be based, the classification of necessities as opposed to luxuries, the claims of the few as compared to those of the many, all these details are still finally undecided. Forest officers were at one time gratified when the area in their charge was free from rights of user ; they preferred to grant privileges rather than to record rights, but it seems probable that their congratulations were premature. Where rights exist, they are settled in a prescribed method, once and for all. The law regulates their enjoyment, there is but one discussion and that merely as a preliminary measure. Where concessions are granted, there can be no definite end unless the forest policy of successive Governments coincide. The general policy it is true is Imperial, but the interpretation thereof is personal, and varies within wide limits. Each Government may be, and doubtless is, right in this interpretation ; but the differences which must occur are destructive to continuity in working the forest. The State forests are as islands in a sea which may all too readily engulf them ; the strong but gentle swell in the offing represents the demand of the general population of the Province ; the surf, dashing against the seawall, the restrained appetite of the rightholders ; whilst the efforts of the concessionists may be likened to waves breaking on an unprotected shore ; without unintermittent watchfulness the

result must be a gradual but certain victory to the invaders.

(12). The chief causes tending to relax this watchfulness originate possibly in failure to recognize the importance of forests, in the economy of a State; they are too often allowed only to possess a strictly local value. But even when this view of the case is taken, deterioration of forests need not follow. The villages in the neighbourhood unquestionably benefit by receiving a very large proportion of the expenditure on the works that are carried out therein; let them receive, too, in money, the full value of their concessions and also be given the opportunity to purchase, at the market price, forest produce at their doors. In this, or in some similar way, they could have no personal interest in forest management nor claim any right to control it; but as long as that interest is admitted and that right allowed, in practice if not in theory, so long will agitation continue and so long will the grievances of the agitators, be they forest officers or tenantry, be liable to decision according to the actual wants of one or the other, instead of in accordance with the relative importance to the State of agriculture and sylviculture. If the interests of the forests are held to be antagonistic to those of cultivation, such relative importance no longer exists, but in a well-ordered State there is not only room but a necessity for both agriculture and forests; the settlement of the one is as necessary as that of the other, for, in either case, without security from sudden or frequent changes, there can be little welfare and no improvement.

Forests and cultivation not antagonistic.

(13). The reader who is interested in these matters can now sum up for himself; certain facts have been laid before him, certain theories have been suggested. The impartial critic will, it is hoped, not be able to complain that undue stress has been laid on demands for the welfare of the forest. The Forest Officer is in theory independent of the forest revenue, but in practice he views its diminution with distaste as restricting the outlay he is permitted on works of improvement and, protection. Still, he knows better than to complain; he desires only that the management of forest areas should be on a secure basis, so that he may be able to arrange 30, 50 or 100 years in advance, for the harvest which will take that period to mature. He desires to eliminate, as far as possible, all elements which may induce a change in management during at least one cycle of growth; and if at the same time he is anxious to restrict, within reasonably liberal limits, the demands on the area under his charge, he is at least actuated by disinterested motives; for his sole reward will be in his knowledge that he has induced improvement in the forests under his charge, and in the recognition of his labors by those who know.

Conclusion.

Statement showing the Incidence of Concessions in one Division in 1894 and in 1898.

Serial Numbers.	Description.	Area in square miles.	C-ft.	Cart-loads.
1	Area of Division ... { Stocked 210	331		
2	Area in which grazing is permitted ... { Unstocked 121			
	... { Stocked 67	185		
	... { Unstocked 118			
3	Area set aside for use of Concessionists as grazing grounds. { In 1894, { Stocked 67	91		
	... { Unstocked 24			
	... { In 1898, { Stocked 69	123		
	... { Unstocked 54			
4	Area available for other cattle in 1898 ...	64		
5	Area available for regular treatment in 1898 .. { Stocked 141	144		
	... { Unstocked 3			
6	Maximum allotment to Concessionists in unreserved timber in 1894, on payment, without liberty to sell ...	..	709,346	
7	Maximum allotment to Concessionists in unreserved timber in 1898, free and with liberty to sell * ...	...	709,346	
8	Maximum allotment in grass as above in 1894 ..	...	...	35,446
9	Do do do in 1898 ...	...	...	47,261
10	Incidence of grant of unreserved wood per acre per annum over area in (5) ...	...	7.9	
11	Incidence of S&I wood as above ...	...	2.6	
12	Outturn necessary per acre of unreserved wood on a 20-year felling rotation ...	...	158	
13	Outturn of S&I as above on a 30 year rotation ...	...	78	

* The grant of 1898 may be more than of 1894, but will not be less.

Tannin Extracts.

During the past few years considerable efforts have been made in the way of practical inquiries in the preparation of Tannin extracts from products of Indian forests, and in their examination and analysis. Forest Officers responded willingly

to the appeals made to them by the Inspector-General to prepare and send in extracts of any materials which, from local experience or practice, it was thought would probably yield extracts of commercial value. Thus many more or less useful extracts were sent to the Reporter on Economic Products and to the Forest School at Dohra, from Burmah, Bengal, the Central Provinces and Coorg. The examination and analysis of these extracts made in Calcutta showed that, although they had all been prepared in much the same manner, viz., by the method employed by the catch boilers in Burmah and elsewhere, they varied very greatly in the amount of tannin they contained. Some of the extracts were sent in a liquid condition, and these were found almost invariably to ferment and spoil in a very short time. Others had been rendered useless by the application of too much heat, and others were reduced in value by the admixture of a considerable quantity of gum and coloring matter, and some were quite useless on account of the amount of dirt and foreign matter which they contained. A number of the better extracts were analysed by Mr. D. Hooper, Curator, of the Economic Section, Indian Museum, and the following results, obtained by him from some of the first extracts prepared by forest officers in the forest, and without machinery, may be interesting :

Name of material.	Dry extract.	Tannin.	Tannin in dry extract.
1 Terminalia chebula, fruit ...	6.4	3.6	56.2
2 " myriocarpa, bark ...	3.4	2.79	82.0
3 Shorea robusta, bark ...	7.9	3.9	49.3
4 Quercus lamellosa, bark ..	5.0	2.72	54.4
5 Terminalia myriocarpa, bark ...	4.0	2.68	67.0
6 Engelhardtia spicata, bark ...	6.0	5.08	84.6
7 Terminalia myriocarpa, bark ...	75.4	29.1	38.6
8 " chebula, bark ...	51.8	29.0	55.9
9 " " fruit ...	59.4	98.4	47.8
10 Shorea robusta, bark ...	68.6	26.8	42.1
11 Acacia catechu, bark ...	70.4	40.8	57.9
12 Terminalia tomentosa, bark ...	68.2	26.85	38.6
13 Engelhardtia spicata, bark ...	65.0	44.0	67.7
14 " " bark ..	2.9	2.56	88.0
15 Terminalia chebula, fruit ...	7.8	4.82	61.7
16 " " bark ...	2.0	1.43	71.5
17 " myriocarpa, bark ...	2.8	2.6	92.8
18 " tomentosa, bark ...	8.3	7.53	90.7

The following report by Mr. Hooper may, with advantage, be quoted *in extenso*.

"In submitting a report on the examination of certain 'tannin extracts received from Forest Officers at Saharanpur, 'Nimar, Central Provinces, Coorg, and Burma, I would offer 'the following remarks on their physical properties and chemical 'composition.

'Most of these extracts were received in a liquid condition, 'and in a few cases the fermentation and development of carbonic acid gas had burst the bottles, and the contents were 'lost. Other extracts were in a thick syrupy state, and the 'rest were soft and sticky. None were hard and friable, as 'one would expect to see in cutch substitutes. The watery 'solutions appeared to have been made with some care, although 'the methods of preparation were not carried to completeness. 'The barks and leaves were immersed in hot water for 'definite periods, but in several instances no attempt was made 'to concentrate the resulting liquors.

'No data were afforded by some of the officers for calculating the amount of extract from the crude material, and even 'where weights and measurements are recorded, a considerable 'loss of extract is indicated. For instance, in calculating the 'amount of solid extract from the raw products used in Nimar, 'Central Provinces, the bark of *Terminalia Arjuna* is shown to 'yield 8 per cent. of extract, the leaves of *Anogeissus latifolia* '6·7 per cent., and the leaves of *Phyllanthus Emblica* 10·7 per cent. These figures are very low and do not reach the estimated proportion of pure tannin actually found in these materials.

'The extracts obtained from fruits and leaves are, from 'my experience, not so satisfactory as those made from the bark 'of the tree. Leaves always contain more mineral matter 'than bark, and salts of potash are at once removed on treatment 'with water. Fruits, on the other hand, contain considerable 'proportions of uncrystallisable sugar which is readily dissolved 'out with the tannin. These two substances, potash and sugar, 'give the finished extract a hygroscopic consistence which makes 'it difficult to powder. The bark preparations are more free 'from those substances which absorb moisture from the air, and 'on this account are not so liable to turn mouldy in damp 'weather.

'The liquid extracts, provided they were manufactured from 'authentic sources, have supplied material for approximately 'determining the value of the more solid extracts. A decomposing fluid, with a mouldy surface and a more or less bulky deposit, is not the best medium for investigation; but by 'ascertaining the amount of solid matter in a measured volume 'of the clear liquid, and the amount of tannin in another 'portion, very concordant results were obtained. In the

‘ following form, these results are tabulated. The first column of figures shows the actual percentage of residue (dried in 100° C.) in the liquid; the second column gives the amount of tannin in the liquid, and the third column records the percentage of tannin calculated on the dry residue. Most solid extracts naturally hold from 5 to 20 per cent. of water, so it must be remembered that the tannin in the third column of the table is calculated on the absolutely dry extract, and is, therefore, higher than it would be if determined in an ordinary commercial sample.”

Analyses of liquid extracts obtained from Tannin materials.

Register No.	Name of tree.	Part used.	District.	Percentage of dry extract	Percentage of tannin.	Percentage of tannin in dry extract.
10000	Phyllanthus Emblica	.. leaves	Nimar, Central Provinces.	11.5	6.48	56.3
10001	Anogeissus latifolia	.. bark	do	6.0	3.08	51.3
10002	do do	.. leaves	do	34.2	10.0	34.4
10003	Terminalia Arjuna	.. bark	do	4.84	3.56	78.5
10018	Pterocarpus Marsupium	.. do	Coorg	3.44	3.48	90.6
10014	Terminalia paniculata	.. do	do	3.2	1.7	75.4
10015	do tomentosa	.. do	do	3.0	2.3	76.6
10016	Santalum album	.. do	do	1.0	Inappreciable.	
10016(a)	do	.. wood	do	..	..	..
10017	Eugenia Jambolana	.. bark	do	.. .95	.. .41	.. 48.1
(10021a)	Acacia ferruginea	.. do	do	..	Traces	only.
10021	do do	.. fruit	do	.. .45	..	..
10018	Terminalia bellerica	.. do	do	3.24	1.55	47.9
10019	Phyllanthus Emblica	.. do	do	1.74	1.21	69.5
10020	do do	.. bark	do	1.3	.77	59.2
10022	Cassia Fistula	.. do	do	2.1	1.30	61.0
	Spondias mangifera	.. do	do	..	..	..
10023	Bolileobera trifluga	.. do	do	2.6	1.58	58.8
10024	Dalbergia latifolia	.. do	do	1.0	.20	20.0
10026	Anogeissus latifolia	.. leaves	do	1.0	.61	61.0
10026	Lagerstromia microcarpa	.. bark	do	1.1	.31	28.1
10027	Lantana	.. fruit	do	1.9	Traces	only.
10028	do	.. bark	do	2.2	do	do
10029	do	.. leaves	do	.6	do	do
10151	Garuga pinnata	.. bark	do	5.2	3.7	70.7
10152	Briedelia retusa	.. do	do	7.0	4.13	59.0
10153	Buchananian latifolia	.. do	do	9.8	5.4	55.1
10154	Butea frondosa	.. do	do	5.2	1.84	35.3
10155	Careya arborea	.. do	do	4.12	2.97	72.0
10156	Lagerstromia parviflora	.. do	do	6.2	4.34	72.2
10151	Garuga pinnata	.. do	do	4.9	3.28	66.5
10152	Briedelia retusa	.. do	do	6.2	4.07	65.6
10153	Buchananian latifolia	.. do	do	16.4	10.42	68.5
10154	Butea frondosa	.. do	do	5.2	1.84	35.3
10155	Careya arborea	.. do	do	6.7	4.32	63.0
10156	Lagerstromia parviflora	.. do	do	5.2	3.50	67.3
10148	Thetta Sandoricum indicum	.. do	Burma	4.98	3.20	64.2
10149	Psidium Guava	.. do	do	11.4	5.74	70.4
10150	Kamyine Diptorocarpus	.. bark	do	8.48	6.46	76.1
10164	Lagerstromia floe-regina	.. root	do	.37	No tannin.	
10174	do tomentosa	.. do	do	1.43	.57	40.1
10177	do microcarpa	.. do	do	.12	No tannin.	

Solid extracts from Saharunpur.

Register No.	Name of rec.	Part used.	Water.	Tannin.	Moisture in water.	Ash.	Tannin in dry extract.
100003	<i>Shorea robusta</i>	.. bark	15.2	16.0	28.0	14.2	18.4
100004	<i>Cassia Fistula</i>	.. leaves	15.0	24.2	17.5	10.0	28.4
100005	<i>Terminalia tomentosa</i>	.. bark	12.2	35.4	13.8	8.7	40.8
100006	<i>Anogeissus latifolia</i>	.. leaves	13.8	22.0	22.4	9.4	25.5

' In discussing the results of the analyses many interesting points may be noticed. The tree yielding Malabar Kino (*Pterocarpus marsupium*) is shown to yield the richest extract. The estimation was performed in duplicate, and the tannic acid was found to be very pure. The barks of various species of *Terminalia* are particularly astringent. The species *arjuna*, *paniculata* and *tomentosa* contain over 70 per cent. of tannin in their extracts. The richness of these *Terminalia* barks should be considered in connection with the recent enquiry of the Director of Kew Gardens with reference to *T. Oliveri*. The barks of *Garuga pinnata*, *Careya arborea*, *Bridelia retusa* and Kamyine (*Dipterocarpus*, sp.) compare most favourably with well-known tanning materials as far as their composition is concerned. An interesting feature in these experiments is the astringent nature of the barks of certain species of *Lagerstræmia*. *L. parviflora* is mentioned in the Dictionary of Economic Products as yielding a dyeing and tanning bark, and in the table the extract is shown to justify such a use from the large proportion of tannin it contains. The bark of *L. microcarpa* Wight (*L. lanceolata*, Bedd.) and the root of *L. tomentosa* afford much smaller quantities..

' It might be noticed that the liquid preparations from Guava bark, *Eugenia jambolana* bark and *Anogeissus* leaves were very insoluble in water after they had been evaporated to dryness, indicating that the heat employed had effected a chemical change in the constituents.

' In order to utilize the results of the analyses for selecting the best materials for making tannin extracts, I should reject all barks and leaves giving less than 50 per cent. of tannin in their extracts and choose the richer kinds for further experiment. Cutch of various kinds, mangrove extracts, and other preparations afford 50 per cent. or more of pure tannin, and it would not be desirable to adopt a lower standard.

' Liquid extracts containing tannin are liable to deteriorate on keeping. The six preparations from Coorg bearing registration Nos. 10151 to 10156 were sent in duplicate; the

' first series were sent direct from the Deputy Conservator of Forests early in November, and the second series came through the Conservator of Forests, School Circle, Dehra Dûn, and was analysed about six weeks afterwards. The results show that three samples had become weaker, two were stronger, and only one was of the same strength as the corresponding liquid received in the first consignment.

' The solid extracts from Saharanpur (Register Nos. 10008 to 10006) contained large amounts of extraneous matter insoluble in water. It would appear that they had been over-dried or burnt in the course of manufacture. The extract from the bark of *Terminalia tomentosa* was decidedly the best of the four samples."

Some good extracts were made in the Sundarbans Division by Mr. Dingwall Fordyce from the bark of *Cerriops Condolleana*, *Cerriops Roxburghiana*, *Kandelia Rheedii*, *Bruguiera gymnorhiza*, *Rhizophora mucronata*. These extracts were analysed by Mr. Hooper with the following results.

Register No.	Source of extract.	Moisture.	Ash.	Insoluble in water.	Sand.	Tannin.	Tannin in dry extracts.
10281	<i>Cerriops Condolleana</i> Choti garan	14.2	14.8	9.7	(5.7)	53.9	61.6
10284	<i>Cerriops Roxburghiana</i> Bara garan	(18.9)	16.8	9.8	(5.8)	53.5	62.1
10287	<i>Kandelia Rheedii</i> Goria	19.5	18.6	14.6	(6.1)	44.5	55.2
10290	<i>Bruguiera gymnorhiza</i> , Kankra	19.9	17.4	8.2	(3.2)	57.0	71.1
10293	<i>Rhizophora mucronata</i> Bhara	11.0	14.5	13.5	(4.6)	39.8	33.6

A large number of extracts have also been tested at the Forest School at Dehra by the Assistant Agricultural Chemist, and the analyses made by him generally corroborate the results obtained by Mr. Hooper.

The next step in the enquiry was a conference held in Calcutta between the Inspector-General of Forests and the Reporter on Economic Products in January 1898, at which it was decided that enquiries should, for the present, be limited to such trees as gave fair promise of yielding extracts of commercial value. Judging from the preliminary experiments, these trees were considered to be :—

- (a) *Acacia arabica*.
- (b) " *Catechu* (Chips of wood).
- (c) *Shorea robusta*.
- (d) *Terminalia tomentosa*.
- (e) *Anogeissus latifolia*.
- (f) *Cassia Fistula*.

- (g) *Cassia auriculata*.
- (h) *Phyllanthus Emblica* (fruits).
- (i) *Pterocarpus Marsupium* (bark from trees felled and of branches, &c)
- (j) *Xylia dolabriformis* (waste wood, sawdust and branches)
- (k) *Cerriops Candolleana*.
- (l) *Terminalia Chebula* (fruits from Burma).
- (m) *Pinus longifolia*.
- (n) *Casuarina equisetifolia*.
- (o) *Acacia leucophloea*.
- (p) *Briedelia retusa* or *B. montana*.
- (q) *Kandelia Rheedii*.
- (r) *Bruguiera gymnorhiza*.
- (s) *Rhizophora mucronata*.
- (t) *Cerriops Roxburghiana*.

Attention was called to the advisability of testing and analysing the raw material as well as the extract therefrom. A quantity of bark, etc., of the trees above-mentioned was accordingly supplied to the Reporter on Economic Products and analysed by Mr. Hooper with the following results.

Tannin values of Indian barks.

		Tannin.	Extract.	Moisture.	Ash.
<i>Terminalia chebula</i> , bark, R. No.	11409	28.6	31.2	11.7	10.1
<i>Rhizophora mucronata</i> do	10759	26.9	40.0	10.9	9.2
<i>Cerriops candolleana</i> do	10282	26.2	28.0	13.3	10.6
<i>Cassia auriculata</i> do	10746	23.0	32.8	11.1	5.9
<i>Cerriops Roxburghiana</i> do	10285	19.2	27.8	9.2	18.0
<i>Acacia dealbata</i> do	11389	17.8	23.6	12.1	4.6
<i>Acacia arabica</i> do	10586-1	16.7	26.0	9.8	10.9
<i>Acacia leucophloea</i> do	10579	16.2	26.0	7.4	9.8
<i>Bruguiera gymnorhiza</i> do	10291	15.9	21.2	9.6	7.3
<i>Briedelia retusa</i> do	10639	15.9	18.6	9.5	11.0
<i>Pinus longifolia</i> do	10581	14.6	26.3	8.9	3.9
<i>Kandelia Rheedii</i> do	10288	12.2	17.7	9.9	9.8
<i>Casuarina equisetifolia</i> do	10462	11.1	14.4	10.3	4.9
<i>Cassia fistula</i> do	10977	9.5	27.9	11.2	11.0
<i>Acacia Catechu</i> wood,	10978	6.8	14.3	5.5	1.5
<i>Pterocarpus Marsupium</i> do	10583	5.4	7.0	10.2	12.9
<i>Shorea robusta</i> N. W. P.					
old trees do	10976	10.0	19.2	11.6	8.4
Ditto Coppiced trees do	10975-1	10.5	21.0	12.4	6.5
Ditto Assam, mature do	11093	13.2	21.2	11.4	6.0
Ditto Old branches do	11093-1	2.8	6.3	13.5	5.1
Ditto C. F. Ditto do	11035	6.7	16.3	7.2	10.5
Ditto Old trunk do	11035-1	4.6	7.5	9.5	6.0
Ditto Young coppice trees do	11035-2	7.1	11.2	10.1	4.0

Tanin values of Indian barks—(continued).

		Tannin.	Extract	Molst- ure.	Ash.
<i>Terminalia tomentosa</i>					
N.-W. P. old trees bark, R. No. 10976		11·8	20·5	12·6	25·0
Ditto coppiced trees do 10976—1		12·3	26·0	19·4	22·0
Ditto Old branches do 10976—2		13·6	19·7	10·0	20·7
Ditto Assam mature trees do 11094		8·6	15·5	11·8	12·5
Ditto Old branches do 11094—1		5·7	7·5	12·0	24·4
Ditto C P, Old bark do 11034—1		26·2	28·7	10·4	21·6
Ditto Young coppiced trees do 11034—2		12·6	16·0	9·1	29·5
Ditto Old branches do 11034		11·7	17·3	9·2	17·1
<i>Xylia dolabriformis</i> saw-dust do 11442		6·1	7·0	9·1	2·4
Ditto Chips do 10442—1		5·4	6·0	8·0	4·1
Ditto Sawdust do 11408		8	1·0	20·8	2·2
Ditto Chips do 11408—1		4·6	5·7	5·6	2·9

Arrangements were next made to ascertain the market value of the extracts made in India, as compared with those in actual use in Europe. Some samples of extracts of Pyinkado, etc., were sent to Germany by favour of Messrs. Von Ernsthause and Co. and were analysed by Drs. Popp and Becker, authorised trade Chemists and Analysts of Frankfurt. The best sample contained 37·24 per cent. of tanning agents and too much coloring material was present. The opinion was given that extracts containing so low a percentage of tannin could not compete with those at present in use in the German market. The extract in use which contains the lowest percentage of tannin is that of Quembracho, which contains 43·2 per cent. of tanning agents; and this can be bought in Germany at 83 marks per 100 kilogrammes, or say, Rs. 9-1-5 per maund or Rs. 247-8 per ton.

Further reports were obtained by favour of Messrs. Ernsthause from Messrs. Schünbank and Sons, of Berlin. The following shows the results of analyses made by them.

	<i>Acacia arabica</i> bark.	<i>Acacia arabica</i> pods.	<i>Terminalia tomentosa</i> bark.	<i>Terminalia tomentosa</i> bark.
Tanning agents	30·00 %	22·80 %	52·50 %	23·40 %
Non-tanning soluble substances	24·40 „	34·10 „	27·10 „	33·40 „
Insoluble	6·20 „	8·40 „	6·80 „	31·60 „
Water	39·40 „	34·70 „	13·60 „	11·60 „
	100·00	100·00	100·00 „	100·00

And they compare this with the analysis of tannin extracts procurable in Germany which is as follows :—

			Liquid extract of Oak wood.	Liquid extract of Chestnut.	Liquid extract of Quem- bracho.	Solid ex- tract of Quem- bracho.
Tanning agents	..	..	28.60 %	30.40 %	39.80 %	68.50 %
Non-tanning soluble agents	..	..	13.70 „	8.20 „	2.40 „	5.40 „
Insoluble agents	...	...	2.20 „	1.80 „	3.20 „	6.80 „
Water	...	...	55.50 „	59.60 „	55.60 „	19.30 „
			100.00	100.00	100.00	100.00

Messrs Schönbank and Sons, report that the extracts from *Terminalia tomentosa* are too dark in colour and require to be decolorated before they can have any chance of finding a market. Further, they state that the samples contain far too large a proportion of non-tanning soluble substances, from 24.40 per cent. to 34.10 per cent as compared with 2.40 per cent. to 13.70 per cent. in the extracts used in the trade, and they conclude that in order to render it possible for tanning extracts made in India to find a market in Europe, it is absolutely indispensable that they should be prepared in a rational, up-to-date manner, that the colouring matter should, as far as possible, be removed from the liquid solutions before condensation, and that these should be condensed in a vacuum.

These reports show clearly that the preparation of extracts in a rough and ready way in the forests is but a waste of time and money. The question of importing modern machinery is under consideration; the methods by which the solution may be decolorated is being investigated and in the meantime experiments are being continued at the Forest School at Dehra.

Extracts are now being carefully prepared and are being forwarded to the Reporter on Economic Products, who has been good enough to undertake to analyse and report on them. Samples of the extracts made at the School will also be forwarded through the Reporter on Economic Products to the Imperial Institute, where they will be examined and reported on, and further inquiries will be prosecuted in Europe.

It must be observed that simultaneously with the inquiries and investigations which, during the last few years have been carried out by the Forest Department under the orders of the Inspector-General, inquiries have also been set on foot by the Imperial Institute regarding tanning extracts, more particularly from the various species of the Indian Mangroves; 'Tanning materials' also form the subject of Imperial Institute inquiry (No. 46 in the Report on Collections for 1895-96) and the tanning properties of *Terminalia Chebula*, *Acacia arabica*, and *Cassia auriculata*, as well as the influence of the locality and degree of maturity of the tree or the fruit, have since then been under special investigation.

In 1898 the Inspector-General of Forests wrote:—

"The main justification for the preparation of tannin 'extracts near centres of the production of tanning agents, in 'preference to places where the material is used, is that they 'contain, or should contain, a much larger percentage of tannin 'for the same weight, than the raw material, and are much less 'bulky to transport. If these advantages are not obtained to a 'very considerable extent, it would be very much simpler to 'send the bark or wood, chipped or powdered, direct to the 'tanneries, and to let the tanners make their own liquor.

The questions which we have to solve are:—

(a) "Whether we can, at a remunerative cost, make extracts which meet these requirements, and which, at the same 'time, contain no such extraneous matter as would render them 'in any way unfit for, or less valuable for practical tanning, than 'the raw material from which they are prepared.

(b) "Whether we cannot, in making these extracts, remove, 'at a remunerative outlay, some of the properties found in some 'of the raw material, which render this less desirable for tanning 'than others.

"This refers more especially to the bark of *Shorea robusta* and *Terminalia tomentosa*, of which enormous quantities are 'available. Both of these, however, tan very dark, much more 'so than *Acacia arabica* and *Cassia auriculata*, and are consequently, only used in admixture with less highly coloured 'material."

What is required is, in fact, a more correct knowledge of how to prepare our extracts, so that European tanners will pay a remunerative price for them. We know that we have in our forests any quantity of materials containing tannin which, in most cases, simply goes to waste; and we have found out the materials which are likely to prove the most valuable. It remains to surmount the difficulty of correctly preparing the tannin extracts, and of placing them before the public in a marketable form at a remunerative price.

II-CORRESPONDENCE.

 More information about Bamboos.

SIR,

In his very interesting paper on the "Indian Bamboos" which appeared in the January number of your Magazine, Sir D. Brandis has in one or two places mentioned my name. I should like, therefore, with your permission, to make some corrections in what I wrote before, and which Sir Dietrich has quoted, and to add some information which may be of interest to others.

At page 9, and again at page 12 of the January number, I am quoted as saying that *Bambusa arundinacea* is full grown 12 years after seeding. I thought so at one time, but a longer experience has proved that this is wrong. I ought to have written that culms, large enough to be used for floating timber, could be obtained from bamboo clumps 12 years old. My present opinion, and that of others whom I have consulted, is that it takes upwards of 20 years for clumps to come into full bearing. Mr Jasper Nicholls was therefore more right than I was on this point.

Wishing to make quite certain, I sent out to a place where I knew that the bamboos had seeded in 1880-81, and had the culms measured. The following are the dimensions:

Average height of culms 18-19 years old—48 feet.

" girth at butt of do. do—15 $\frac{1}{4}$ inches.

These bamboos will grow larger still I doubt not.

Three years ago I passed through a bamboo forest where the bamboos had seeded in 1869-70, or about that time, and noticed that the culms were of great length and thickness. I have sent to have these 29-year old bamboos measured and hope to be able to give the figures later on.

At page 17 of the January number, *Ochlandra travancorica* is mentioned as a species of the higher ghâts of Travancore and Tinnevely. This *Ochlandra* does grow on the hills, but it also grows very extensively in the plains. In the latter habitat it is generally found as the undergrowth in high forest, and should the forest be cleared for cultivation, the *Ochlandra* will spring up after the cultivation has been abandoned, and form impenetrable thickets stretching for miles. On the hills, this reed may often be seen growing naturally in dense thickets, with hardly a tree to be seen in them.

As regards the flowering of this species, I regret that I was in error here. The valley in which the *Ochlandra* flowered

in 1875, was not the same where flowering occurred in 1882, though they are only a few miles apart; nor has this species flowered again in the second area up to date. Consequently, the period of flowering must be much longer than seven years, and the hillmen put it at 30 or 40. Sir D. Brandis says that this bamboo also flowers sporadically, but this is very exceptional. One does occasionally see clumps flowering when there are no signs of a general flowering, but such an event would be sufficiently uncommon to be recorded in the Forest officer's notebook. To sum up, I think it will be found that *Ochlandra travancorica* should be classed among the species of bamboos which flower periodically, but that the areas of flowering are much less extensive than in the case of *Bambusa arundinacea*.

At page 24, Sir D. Brandis refers to Mr. Thomas Routledge's scheme for making paper from bamboos. By the kindness of a friend, I have obtained the loan of a copy of the indenture made between the Secretary of State for India and Mr. Routledge on 17th March 1882, by which a concession was granted to the latter to select certain tracts in British Burma for the exclusive right to "manufacture paper stock from bamboo fibre and other such vegetable fibres" for 30 years.

Mr. Routledge never himself visited India or Burma, but he sent out a colleague on whom he could rely, who travelled extensively over those countries, experimenting and collecting information. These inquiries went to show that, however admirable the stock procurable from bamboos was, the cost of carriage to England would prevent its paying, when brought into competition with paper stock obtainable from spruce and other timber. Mr. Routledge, therefore, abandoned the idea of forming a company for the purpose of importing bamboo stock into Europe, but until the time of his death he always had a high opinion of the strength of this stock and of its suitability for making paper.

About ten years ago, the manufacture of paper from *Ochlandra travancorica* was taken up in Travancore, but unfortunately the material proved difficult of treatment. A very large quantity of caustic soda was required to reduce the fibre to stock, and an unusually large quantity of bleaching powder had to be employed to make white paper out of the yellow coloured stock. Then, experiments had to be carried out to ascertain what aged culms gave the best results, no experience being obtainable from elsewhere on this point. The cost of erecting the works, moreover, far exceeded the estimates. The business was carried on for about 5 years, and information on many points was recorded, but then funds ran out, and just as there seemed some prospect of the concern paying, work had to be stopped for want of money.

This was very unfortunate, for the experts all agreed that for strength and durability, the paper made from the *Ochlandra*

was superior to the best esparto. For cotton mill wrappers and purposes for which strength is a desideratum, this material stands unrivalled. I quite hope to see the manufacture taken up again some day.

Sir Dietrich Brandis refers to the age at which bamboos should be cut for paper making. In respect to the *Ochlandra*, the best results were obtained from shoots 6 to 9 months old. If too young, the quantity of paper turned out from a ton of culms is very small, but if the culms are too old, the quantity of chemicals required becomes excessive.

T. F. BOURDILLON.

QUILON,
16th March, 1899.

Forestry in New South Wales.

SIR,

The trenchant criticism which appeared in the December number of the "Indian Forester," just to hand, on the report of the Forest Department of this Colony for periods 1895-1897, commands the appreciation of many here, who are interested in the advancement of a much neglected interest.

As one having an opportunity of perusing that report in its original form (it having been mutilated and largely curtailed by disinterested officials before reaching the printer), I would like to briefly sketch for the information of your readers, and partly in reply to that criticism, what the position of Forestry is in this Colony.

To begin with then, the interest is here politically managed, the true meaning of which can be readily comprehended by those acquainted with the devious courses and irresponsible actions of Party Government. The only legal power afforded is a section of the Crown Lands Act, which authorizes the issue of licenses to fell timber and enables regulations to be framed, controlling the exercise of licenses and the girths at which timbers may be felled. Regarding policy for the proper establishment, working, replanting or improvement of forests, we have practically none, and the technical and scientific aspect of forestry is totally ignored. Portions of the Crown estate which include timber-wealth, are temporarily reserved for the preservation of that wealth, and then, as a general rule, leased under tenures or otherwise settled upon for pastoral purposes at the instigation of the Crown Lands Department. The

supervising officials, who are supposed to attend to forest interests, are not under the control of the Forest section but of the Crown Lands authorities, and the official head in forestry is the Administrative Under-Secretary of the Crown Lands department.

With regard to our timber-wealth it was originally enormous; but through neglect, waste and mal-administration it is rapidly diminishing, and through lack of a policy to provide land definitely and permanently for the growth of forests, there is little likelihood of the remnant being saved or the position bettered. I enclose for your information a pamphlet dealing with our commercial timber, their uses, value and distribution, after perusing which you will the more readily understand how almost criminal it is that such national wealth should be so neglected. The introduction of a trained official or Conservator to supervise and control forest matters here would, I fear, be useless, unless he were capable of educating the people (a difficult task) in the economic and scientific value of conservation, and of convincing the Powers (a much more difficult undertaking) of the necessity for establishing a proper system of forestry for the benefit of the nation. To revert now to certain omissions in the report which formed the subject of criticism, if they can be of any importance where so large a measure of chaos in forestry matters exists, it may be mentioned that tables containing details of operations, as far as it was possible to record them, were cut out of the original report by higher administrative officials, *presumably to save cost in printing*. The timbers referred to as red gum and Cypress pine are respectively *Eucalyptus rostrata*, the red or flooded gum of the interior, and *Callitris calcarata* and *Callitris verrucosa*, the red and white Cypresses of central and western New South Wales. The record of firewood sales is, no doubt, in a properly-managed forest an important item; but here the law allows any person to enter a forest and obtain firewood without license or payment. The Forestry Bill in contemplation is a measure that aims to create national forests of a permanent character and to vest their control in an administrative department, besides amending and enlarging the powers given under the present law and enacting a definite set of penalties for offences against forest laws; but the chances of its passing the legislature in its present form are not hopeful, as the majority of our Politicians look upon forestry, or rather forest wealth, as something created by Providence purely for exploit by their constituents. Any attempt to form a Working Plan for one or a series of forests and to adhere to it would be looked upon by them as an infringement of the liberties of the subject, and as a conservative innovation adverse to the (so-called) democratic tendencies of the people. Perhaps the foregoing explanation of forest affairs, as they exist here, will in some measure indicate the difficulties to be contended with, and

account for much in the subject report, that may have been incomprehensible to those of your readers, who are acquainted with proper forest systems.

SYDNEY,
24th February, 1899.

COLONIAL.

Tussur Silk culture.

SIR,

The Government of India, some years ago, with a view to promoting the Silk industry of the Deccan, offered to supply the Government of His Highness, the Nizam, with Silk-worm eggs of the "Univoltine" variety, if it were willing to engage in the experiment.

As I had on a previous occasion (by order) sent to the Nizam's Government a report on the Tussur sericulture of Hyderabad, setting forth my conviction of the great future of this industry, if encouraged and fostered by the State, I advised that the offer of the British Government should be declined for the following reasons.

Since Mr. Wardle, F.C.S., F.G.S., had discovered a means of winding off the Tussur silk, as finely as that from the cocoon of the Mulberry tree itself, and dyeing it of any tint or color, I thought it wrong that this natural resource of the country should be neglected for the Univoltine, which gives but one crop of cocoons in a year and the introduction of which would have necessitated the planting of millions of Mulberry trees, of the *Morus multicaulis* species; whereas, the jungles of *Terminalia tomentosa*, on which the Tusser worm feeds, extend uninterruptedly for miles in the natural forests, as if they had been created for the propagation of this industry.

As no efforts have since been made for the encouragement of Tussur sericulture, I beg to draw attention to the special source of wealth in connection with it, and I propose proving this upon authentic data.

Owing to repeated blights on the Mulberry tree, there has been in Europe, for the last 60 years, an increasing disposition to resort to foreign sources of supply to replace home deficiency. Asia, especially China, Japan, and India, have been turned to account to satisfy the European demand. The Tussur is one among many kinds of cocoons that would be a sound substitute for those of the Mulberry tree. It is bright and elastic, while its strength of tissue admits of the thread

being diminished in winding off, without losing any of the qualities required by the dyer and the loomsman.

Mr. Wardle, in his book, "The wild silks of India," says of Tussur. "Organzine and tram Tussur, are shown to be of the quality and state of manufacture now required in England for weaving, and a good representation of its manufacture gives a size of 255 deniers (15 drams per 1,000 yards)" "The sizes of the Tussur generally used in England, run from 152 deniers (9 drams) to 255 deniers (15 drams)." "These are very coarse sizes, and must necessarily be unfit to produce such fine textile works as the Mulberry silk, which is manufactured into Organzine and tram, of 21 deniers and upwards (1½ drams), and from which are made the finest silk fabrics."

"The want of fineness and quality is owing to the imperfect and unskilful mode of manipulating it from the cocoon upwards, and a want of better machinery to prepare it in the raw state."

"The improvement in quality, fineness, and cleanness in the Organzine Tussur, manufactured under my own superintendence, will be seen to be most marked; instead of the coarse sizes of Tussur now used of 152 to 255 deniers (9 drams to 15 drams) there may be obtained, by proper management, Organzine and tram of excellent quality, from the *same* cocoons, of 51 deniers (3 drams) and upwards, which can be woven into a great variety of stuffs, for which, until now, only the Mulberry silk has been available."

"The attention of all interested in, or connected with silk manufacture, cannot be too strongly drawn to this fact, nor its value be overrated."

"There is a most important future in store for the Tussur silk industry, and as great improvement will take place, as resulted from the introduction of proper machinery and skill, many years ago, in the Mulberry silk districts of Bengal, when it was found that, Bengal silk, in place of being almost unworkable, could be manufactured in such a way, as to bring it into extended use in Europe, so as to rival even French and Italian silks."

The great consumption of silks of all descriptions, and the almost limitless quantity of silk used, are well known, and the wealth of this country would be much enhanced if only the production of her Tussur industry were increased.

At present, it is in the hands of ignorant and superstitious men ("Kolies") who rear and tend the silk-worm; and these men make a bare subsistence, with the result that only a limited quantity of coarse material is manufactured at Kosgee, Mojaithpett, Mominpett, and other places. It is well-known as Tussur Cloth in India, and in the country is used as *petumbers* for women, and *murras* and *moogtas* for men

The Government might, at small cost, establish a farm for the purpose of instructing the natives, how to propagate the Tussur silk-worm on sound principles, and order a Filatory to enable them to wind off the Tus-ur silk, as finely as that from the cocoon of the Mulberry.

There are a number of trees in the Nizam's jungles that will nourish the Tussur silk-worm. *Terminalia tomentosa*, *Terminalia pentaptera*, *Zizyphus jujuba*, *Ficus religiosa*, *Terminalia Oattappa*, *Terminalia alatu*, *Bombax pentaphyllum*, *Lagerstrœmia parviflora*, *Bassia latifolia*, *Tectona grandis*, and even the *Eucalyptus*.

It is needless to dwell here on the simple treatment needed by the silk-worm, while on the tree, that supplies it with all necessary nutriment. Almost all it needs is protection from its numerous enemies during the 35 days that constitute its life.

The cocoon is completely formed in 8 days, and all who have experimented on its cultivation, have proved, that the cost of fresh materials of production, would not be more than one rupee per one thousand cocoons. If more extended information be wanted regarding either the nurture and treatment of cocoons or preparing them, I shall be glad to furnish it, or to render any other assistance that may be in my power.

T. F. CATANIA.

P. S.

At some future time I will show how a hybrid race can be created, with the greatest advantage to this country. The experiment was undertaken some years ago, by a German and myself, with success. A short account appeared regarding it, written by Mr. Rodgers, late Member of Council, Bombay, in the "Society of Arts Journal."

T. F. C.

Gestation of the Elephant.

SIR,

Our Burma *mahauts* invariably maintain that the period of gestation in the elephant extends to three years. It may, therefore, be of interest to put on record an observation bearing on this statement.

Forest elephants in Burma are simply hobbled and turned loose in the nearest jungle to feed, and hence, unlike the Commissariat animals, are practically in a state of nature, and breed freely.

In June 1897, one of the *mahauts* reported that his elephant had been covered by the tusker attached to the division, whilst the animals were turned out to feed. The act was observed every evening for about a week, from about the 18th to the 25th May, 1897. Neither of the animals showed signs of sexual excitement previously, though the male paid assiduous court to the female for a few days before coition was permitted. They were both at work at this period—dragging logs—and gave no trouble to their attendants. The report was noted, but, I am sorry to say, forgotten, till the 3rd November 1898, when, in the evening, the elephant gave birth to a female calf.

Fortunately, that day she had only carried a light load for a short march. The baby, though so weak that it had to keep itself upright by holding on to a bamboo with its mouth, was perfectly healthy and well-formed, and after a day, could stand and suckle. The period of gestation, therefore, had been a little over seventeen calendar months, or almost exactly eighteen lunar months.

C. B. S.

The Longicorn beetle on Mulberry trees.

SIR,

In his letter on this subject in the 'Indian Forester' for February, B. O. C. gives no hint as to the reason of the larvæ preferring the heart-wood of the mulberry to the sap-wood. May it not be that the larvæ of this particular species cannot put up with the excessive sap found in the sap-wood, since other members of the *Cerambycidae* are known to have a particular aversion to excessive sap?

The well-known *Oncideres vomicoso* (Transformations of Insects, Duncan, p. 353), which caused such havoc among the *Albizia Lebbek* (Benth) trees in Rio Janeiro, prefers the sap-wood of that tree but cannot put up with the sap. The species was, therefore, driven to devise some expedient to overcome the difficulty, and, accordingly, it adopted the following clever plan. The perfect insect selected branches which were practically all sap-wood and laid its eggs in them. Then it retired lower down the branch and carefully gnawed, an inch deep or more, all round the branch, girdling it, in fact

to prevent the sap circulating. Were this girdling not done and the flow of the sap not checked, Prof. Duncan says, that the larvæ would suffer from the too great abundance of liquid in their immediate neighbourhood, and that the diminution of the sap is necessary for the perfection of the metamorphoses.

The Punjab Longicorn larva having to deal with a quickly-grown tree, with sap-wood very full of sap, and heart-wood comparatively soft, possibly solved the difficulty of its own safety by the simple expedient of retiring to the heart-wood; while its relation in Brazil was obliged to acquire the instinct to actually girdle the branches, when in its perfect state, in order to ensure the safety of its progeny.

P. H. C.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Our Appendix series and "Stray Leaves from Indian Forests."

We have been favoured with interesting notes on the Deodar, the Sâl, the Shisham and the Khair for publication in our appendix series, and we trust that our readers will, through the medium of the "Forester," supplement the information recorded in these appendices, by relating their experiences and observations regarding the growth and treatment of the valuable forest trees. It is hoped that, in this way, a complete monograph of the life-history and sylvicultural exigencies of each species will be available, and furnish a chapter in that volume of "Stray leaves from Indian Forests," which our Inspector-General has in view.

The Forest Revenues—1898-99.

We are informed that the latest figures telegraphed to the Comptroller-General justify the expectation that the surplus for the year will amount to Rs. 86,45,000, of which Burma alone contributes no less than Rs. 59,45,000. The net results are better than those of 1897-98 by Rs. 13,31,000; and it is highly probable that there would have been a

surplus of nearly 100 lakhs, had not the net revenue in the Bombay Presidency been reduced to Rs. 5,18,000, and that of the once financially prosperous Central Provinces dwindled to Rs. 78,000.

The Paris Exhibition.

The following extract from the Gazette of India, Part I, dated 4th March 1899, is re-produced :—

‘The Paris Exhibition Commission, finding that it would be quite impossible to accommodate in the main buildings, the exhibits from the Colonies and Dependencies of the various nations proposing to participate in the Exhibition, decided to group all Colonies and Protectorates, including the French, in the Park of the Trocadero, the countries interested being left to provide all the necessary buildings required for the display of their exhibits.

‘The British Royal Commission succeeded, after prolonged negotiations, in obtaining from the French Executive an allotment of an area of 60,000 square feet of space, in the Trocadero grounds, for the exhibits from India and the Colonies.

‘Of this space, an area of about one-third has been allotted to the Indian and Ceylon Committee, and arrangements have been made to erect handsome and suitable pavilions on the site for the reception of approved Indian and Ceylon exhibits.

‘The Indian Section, will be divided into three courts :—

- (a) ‘The Imperial, in which the exhibits of the Government of India and of Native States will be shown ;
- (b) ‘The Private Exhibitors’, in which the more artistic productions of Indian Manufacturers, Merchants, and others will be displayed; and,
- (c) ‘The Commercial, in which the trade and economic samples will be exhibited.

‘The total space at the disposal of the Indian Committee is exceedingly limited, and intending exhibitors are therefore advised to make as early application as possible, to prevent disappointment.

‘In order to partially defray the heavy cost the Indian Committee have incurred in erecting the Indian Pavilion, a general charge for space will have to be made. The rate will necessarily depend on the position of the space required, but the minimum charge for space on the ground floor will be at the rate of £1 per superficial foot,”

It has now been arranged to erect in the Imperial Court an elaborate, central, arched structure, which will be made up of carved wood from Burma, the Punjab and Native States, and serve as a means of displaying whatever exhibits are being sent by the Forest Department and Native States. The designs for the imposing edifice, or trophy it may be called, have been artistically worked out by Mr. Ribbentrop, who is taking the greatest interest in the matter. We feel confident now, that the Government of India will be worthily represented, and we trust the Imperial Court will be one of the most attractive in the Exhibition. It is likely that Mr. Gamble, who has recently retired from the service, will be placed in charge of the exhibits in Paris.

The retirement of Mr. J. S. Gamble, M.A., F.L.S., from the Forest Service.

In the Government of India Resolution, reviewing the report of the Imperial Forest School for 1897-98, dated Calcutta, 25th February, we find the following recognition of Mr. Gamble's work at the Imperial Forest School and of his services to Indian Forestry.

"The Government of India are pleased to observe that the members of the School staff have performed their duties to the Director's satisfaction, and to record their appreciation of Mr. Oliver's and Mr. Gamble's efficient management of the School. The latter officer has now relinquished the post of Director of the School, and intends shortly to retire from the service, of which he has been a member for 27 years. He has been Director for eight years, and it is mainly due to his able management that the Forest School has reached its present high standard. The Government of India desire to record their thanks to Mr. Gamble for the excellent work he has done at the School, and for the great services he has rendered to Indian Forestry by the many important scientific publications associated with his name. The *Manual of Indian Timbers* is recognised in India and in Europe as the standard work on the subject of which it treats, and as a monument of laborious research and wide and accurate botanical knowledge."

Born in 1847, Mr. Gamble took his degree at Magdalen College, Oxford, and became a successful candidate for the Indian Forest service in 1868.

He was one of those early students of the *École Forestière* at Nancy, who had the benefit of a preliminary course of training

under that eminently practical Forester, M. Clement de Grandprey, then Inspector at Haguenau. He entered the forest school in 1869, and with an interval passed at St. Andrews when, owing to the war, the school was closed, he completed his studies in the autumn of 1871. He not only passed out of the school with distinction, but was even then famous for his Botanical knowledge. The first year of his service was passed in Burma, after which he was transferred to Bengal.

With intervals of special duty, during which he was employed as Inspector-General, on the Forest Code Committee, and on the compilation of his work on "Indian Timbers," he held charge of the Cooch Behar, Darjeeling and Jalpaiguri Divisions, till he was appointed, with less than eight years' service, to act as Conservator in Bengal in 1879. In 1882, Mr. Gamble was specially selected to go to Madras, and confirmed in the class of Conservator. His services in Madras extended over eight years, during which he was chiefly instrumental in giving effect to the suggestions of Sir Dietrich Brandis regarding Forest Administration in that Presidency, and in carrying through the highly-finished settlements, with their carefully-detailed records of rights. In 1890, Mr. Gamble was appointed Director of the Forest School, and the good work which he has done in that office at Dehra Dún, will be gathered from the report read at the last prize-day, and from the speeches on that occasion, which are reproduced elsewhere. We are more concerned with the loss sustained by the "Indian Forester" owing to his retirement from the service having necessitated his withdrawal from the post of Honorary Editor: but we trust that Mr. Gamble will often find leisure to contribute to his old friend, and we heartily wish him a long and happy life in the old country.

VI.—EXTRACTS, NOTES AND QUERIES.

The retirement of Mr. A. T. Shuttleworth, Conservator of Forests, Bombay.

The following notice is recorded by a contemporary under the heading

"A Distinguished Forest Officer."

By the retirement, from the 1st April, of Mr. A. T. Shuttleworth, Conservator of Forests, Central Circle, who proceeds to Europe to-day, a great void is caused in the Bombay Forest Service. For upwards of thirty years this officer has been at the head of the Department, and has been the life and soul of it, administering it with conspicuous zeal, con-

scientific devotion and ability. The Forest Department loses in him a distinguished Chief and the Government of Bombay a servant whom, without wishing to cast a slur on the officers remaining, it will be almost impossible to replace. His entry into the service recalls the period when Lord Elphinstone was Governor of Bombay, for it was in 1856 that he first came out to India to serve as Assistant Paymaster in the old Indian Navy—and he has been serving Government, with but a slight interruption of three months, ever since, *viz.*, 43 years, thirty years of which have been in the Bombay Forest Department. While attached to the Navy, he was on board the Hon'ble East India Company's Frigate, *Feroz*, throughout the Persian War; was present at the landing of Hallilah Bay, and bombardment of Bushire; also at the bombardment of Mohammerah and capture of the forts; was present in H. M.'s Gunboat *Clyde* during the operations against the Waghirs in Okhamandal, including the bombardment of Bet; he commanded a party of the seamen of the *Clyde* and a gun battery at Boopun Bunder; and finally he served in a Naval Brigade in charge of the *Clyde's* party and guns at the bombardment of Dwarka.

On the abolition, in 1863, of the old Indian Navy, which included the Indus Flotilla, a flotilla that rendered such excellent service during the Mutiny by taking stores and troops for the relief of the Punjab up the Indus to Multan, Mr. Shuttleworth was appointed to the Bombay Forest Department and was first sent to the Belgaum-Dharwar District, as it was then known. Shortly after, he was posted to Bombay as Conservator of Forests and Superintendent, Botanical Gardens, and subsequently, in 1865, he served in Kolaba. Here it was that he distinguished himself by his bravery in saving upwards of 100 lives in putting out in open boats to various wrecks, such as the *Chapman*, *Zenobia*, *Berwickshire*, *Die Vernon*, and *Trizah*, off the Konkan Coast. The merchants of Bombay as a token of their admiration for his gallantry, presented him with a gold chain and a purse of 400 guineas, and the Bombay Government a gold watch; the Bombay Harbour Board with a vote of thanks in vellum; the Royal Humane Society with a bronze medal; and the Albert Medal of the 1st Class was given by her Majesty the Queen. But this was not all. The Shipwrecked Mariners' Company gave him a gold medal; Lloyds a silver medal, and both, the Royal Humane Society and Lloyds presented him in addition with a vote of thanks, in vellum, through the Secretary of State for India.

Of such a record any man might be proud. But it has not been in the direction of personal valour alone that Mr. Shuttleworth has gained distinction. He has proved himself an able administrator and valued adviser of Government on all matters affecting the welfare and interests of the Forest

Department during the thirty years he has been Conservator of Forests. The reorganization of the upper and lower controlling staff of the Department has been carried out under his *régime* and the management of the forests in the Deccan, Konkan and Guzerat has been placed on a thoroughly sound footing.

During both the 1877 and 1897 famines he was actively engaged in various relief operations, and in the latter period, after a service of over forty years, when his strength might be thought to have waned, he was seen labouring, with the same untiring energy and zeal as before, as Superintendent of the Famine Fodder operations in the Presidency. The only recognition Mr. Shuttleworth has received at the hands of Government for his arduous labours in the Forest Service, if recognition it may be termed, was during the tenure of office of his Excellency, Lord Harris, who appointed him an Additional Member of the Local Legislative Council, and he retained this honour till about the beginning of last year.

Mica in Bengal.

From a paper dealing with the mica mines in Bengal, contributed by Mr. A. Mervyn Smith at the meeting of the Institution of Mining and Metallurgy on February 15th, it appears that the industry is a very ancient one, the methods of mining the mica and preparing it for market having been in use for centuries. The mica occurs in pegmatite veins running through foliated rocks, and is taken out from open cuts made in the decomposed granite, and abandoned as soon as solid rock is reached. The miners are a local tribe called Bandathis, men, women and children all working at the mines in the dry mouths when there is no agricultural work in the fields to be done. The books of mica are chiselled out, the work being aided by large fires when the pegmatite is hard, and split into sheets of about one-eighth of an inch in thickness. The rough edges are then trimmed, and the sheets sorted into four qualities and several sizes; the best "ruby" mica, which is unaffected by high temperatures, being worth 20s. per pound when in large sheets, while small sheets only fetch 2d. per pound. The uses are well known and the consumption is now increasing, but appears to have been greater in early times. The output was given by Dr. McClelland in 1849 as 100,000 maunds, or about 73,000 cwts., and is estimated by Mr. Mervyn Smith at less than 20,000 cwts. in 1895. He also states that nearly all the mica used in the arts comes from these mines.

NATURE,

February 3rd, 1899,

Removal of *Cryptococcus fagi*.

To rid beech trees of that dangerous parasite, *Cryptococcus fagi*, which causes much anxiety to foresters, many methods have been tried. Solutions of soft soap, methylated spirit, and so on, applied to the skin of the tree, are of no avail when the bark has become much decayed. External remedies having in such cases proved useless, Mr. John Shortt, the head forester upon the estate of Sir Matthew White Ridley, Bart., has tried internal ones, and the results are mentioned in the recently-published volume of *Transactions* of the English Arboricultural Society. Thirty years ago, several trees which were in the last stages of decay were selected, and three holes were bored in the trunk of each, about two feet from the ground, standing downwards, and converging towards a common centre. Sulphur, saltpetre, and other substances were placed in the holes; sulphur in one tree, saltpetre in another, and something else in a third, and the holes were then securely plugged. All the trees died except the one that had been treated with sulphur. Since these experiments, several other beeches have been treated in the same way, and with equally satisfactory results. The operation, it may be added, is performed in the autumn. These experiments in practical forestry have excited great interest among foresters. It is hoped that the matter will be taken up in a scientific way, and that the chemical action of the impregnated sap will receive elucidation in a form which will be of practical use to the owners of woodlands throughout the country.

NATURE.

February 23rd, 1899.

The Imperial Forest School at Dehra.

DISTRIBUTION OF PRIZES.

Prize day at the Imperial Forest School, Dehra Dûn, was held on Thursday, the 30th March. Mr. Holderness, C. S. I., Secretary to the Government of India, presided, and distributed the prizes. The afternoon was exceptionally cool, and the residents assembled in full strength to witness the distribution. Mr. Ribbentrop, C. I. E., Inspector-General of Forests, opened the proceedings by calling upon Mr. Hill to read his report, which was as follows :—

"Mr. Holderness, Mr. Ribbentrop, Ladies and Gentlemen, and Students of the Imperial Forest School.—As you all know I have only quite recently taken up the appointment of Director, and am, therefore, not in a position to report to you more than the bare facts concerning the work of the past year. It is worthy of note that our Forest School, the establishment of which in 1878 will, no doubt, be remembered by some of you, attains its majority in this year.

"The regular staff of the school during the year has consisted of Mr. Gambia, the Director till a few weeks ago, Mr. Gleadow, Deputy Director, Mr. Gradon and Mr. Caccia, Instructors, the latter having replaced Mr. Osmaston in May last. Babu Upendra Nath Kanjilal has continued in his post as vernacular Instructor, and Babu Birbal has filled, as usual, the post of Curator and assistant in vernacular instruction.

"The classes now passing out of the school, that is, those of the years 1897-1899, are somewhat smaller than those of previous years. At the Entrance examination in 1897, only 47 candidates presented themselves, and of these 26 qualified. Only 18 actually entered the school, and these, with two University graduates, who are exempted from the Entrance examination, one student who had passed in a previous year, and three of those who failed last year and were admitted for a third year, made up a higher class of 24. Of these, two left during the course, reducing the number to 22. To the lower class, six students, including one who had failed last year, were admitted.

"It is satisfactory to record that the classes which entered in 1898, began with a respective strength of 37 and 11, and now number 32 and 10, that is, 42 in all. No less than 56 have passed the qualifying examination this year, and it is probable that 40 or 45 will enter the upper class next month, and 10 or 12 will join the lower class; so that, any difficulty that may have been felt in attracting suitable recruits, seems to be disappearing. If the classes that have just undergone final examination are numerically small, they make up, in some measure, by the excellent way in which they have passed the test of the examinations; for but one student out of 28 has failed. This is very different from last year, when no less than eight failed out of thirty-seven. Moreover, it is due to the solitary failed student to say that 18 months ago he met with an accident in the Laboratory, which seriously damaged his eyes, and besides invaliding him for several months, has considerably interfered with his studies all through. I hope he may be well enough to stay on for another year.

"The marked improvements this year are due, no doubt, to some extent to the fact that the smaller the classes the better the instruction to the individual student: but I think it may be safely claimed, even with as yet only one year's experience of the changes, that the raising of the standard of the Entrance

examination, and the extension of the course by two months' practical work in the forest at the very beginning, are the main factors which have conduced to the passing of a better percentage. The good results of the year are further accentuated by the gaining of *honours* by a student in each class. Daulat Ram, the honours man of the Upper Class, besides being first in several subjects, has gained the unique distinction of obtaining not less than 75 per cent, that is, honours marks, in every single subject from forestry, to forest law and accounts. Daulat Ram is a stipendiary student of whom the Punjab Forest Department may be proud, and it is a pleasure to observe that the enjoyment of a stipend while studying, and the certainty of employment, even if he only narrowly passed, have not in any way deterred him from working hard and taking the highest place. Mela Ram, who was distinguished himself by obtaining honours in the Lower Class, is second to none in proficiency in that all-important subject, silviculture, notwithstanding that he has been instructed entirely in the vernacular. He is a private student, and, like Daulat Ram, hails from the Punjab.

"For all passed students the greatest prizes are, of course, suitable appointments, and applications have already been received for seven of the nine passed private students in the Upper Class, and for five in the Lower Class, of whom there are unfortunately only three. Medals have been awarded by the Board of Control to the following students for proficiency in special subjects :—

"*Upper Class*.—Silver Medal.—A special silver medal for the most distinguished student of the year (1st in Forestry, Forest Engineering, Botany, Mathematics, Forest Law and Zoology), Daulat Ram—Bronze Medals :—Silviculture, K. Govinda Menon ; Forest Engineering, K. Govinda Menon ; Botany, K. Govinda Menon ; Surveying, R. Sama Rao.

"*Lower Class*—Silviculture and general proficiency.—Mela Ram ; Utilisation and Working Plans and general proficiency, Chet Singh.

"The prizes of the year from the prize funds, or kindly given by the Board of Control, the Inspector-General of Forests, the School and other Forest Officers, are awarded as follows : (1) Best student in Upper Class (Board of Control's prize) Daulat Ram ; (2) Best student in Lower Class (Inspector-General's prize), Mela Ram ; (3) Best student from the Madras Presidency (The Campbell-Walker prize), R. Sama Rao ; (4) Best in practical Forestry, Upper Class (Director's prize) K. Govinda Menon ; (5) Best in practical Forestry, Lower Class (Mr. Beadon Bryant's prize), Audh Raj Singh ; (6) For the best note book in Forestry and Forest Engineering, Upper Class (Mr. Gleadow's prize), G. S. Lasrado ; (7) For the best note book in Forestry and Forest Engineering, Lower Class

(Mr. Milward's prize), Mela Ram ; (8) for the best Herbarium (Mr. Gamble's prize), G. S. Lasrado ; (9) For the best Entomological collection, E. R. Coomber ; (10) Best athlete of the year (Inspector-General's), D. A. Allan.

"The health of the students has been exceptionally good. There have been no serious illnesses, the worst case being one of persistent remittent fever.

"The event of the year to all of us, officers of the department and of the school, students, and his many friends, has been the retirement of the Director. Associated with Mr. Gamble ever since our student days, when we, like the students here, were anxious for our certificates, I may be permitted, I trust, to briefly speak of his great worth, and of the loss we all suffer through his retirement. Mr. Gamble's high scholarly attainments, his wonderful *esprit de corps* inculcated at L'Ecole Forestière de Nancy, his untiring energy, and his enthusiasm for his profession, all combined to make him a model Director, such as the school is not likely to see again, now that the department is recruited with younger men who have had no opportunity of graduating at Oxford or Cambridge. As a sound forester he had the highest reputation, and his work in botanical science and research has made him famous all over the world. The excellent relations which endeared him alike to his officers, his students, and his friends, were only too clearly demonstrated, when the time came for saying good-bye. Our only satisfaction lies in the fact that he has retired at a comparatively early age, in good health, and with the prospect of enjoying that long and happy life at home which we all so heartily wish him.

"The members of the staff have earned the favourable notice which Mr. Gamble would desire me to make of their services, and our thanks are due to all those who assist temporarily from time to time, viz., to Mr. Duthie, to Mr. Reynolds and to Dr. Leather. Also to the members of the office and forest staffs who all readily help in any school work.

"Passed students,—I congratulate you, and wish you, one and all, a long and prosperous career.

"In conclusion I beg to thank you, Sir, for so kindly coming out of your way to preside here to-day, and you, ladies and gentlemen, for your welcome presence at our annual prize-giving. I also desire to convey the best thanks of both school officers and students to the members of the Board of Control for the amiable and altogether satisfactory way in which their not very pleasant duty has been performed."

Mr. Ribbentrop then said :—"Passed students, you have come unhurt through the mill of the Board of Control, and this is eminently your fête day. It seems, therefore, but proper that I should in the first instance address a few words of congratulation to you. The results of the examination are good,

exceptionally good. This year there is not merely a strong head followed, as on many previous occasions, by a long straggling tail, sometimes still further stretched by grace marks, but a strong and full body of well-passed students. The tail is gently tapering and short, and, indeed, almost wanting entirely, since all but the one failed student passed satisfactorily. I see two honours men before me—who will presently appear in full view of everybody—Daulat Ram and Mela Ram—I greet you as worthy representatives of the school “Ram-Ram.” All this is specially gratifying to us connected with the school as Mr. Holderness, the Secretary to the Government of India, in charge of our department has honoured us on this occasion with his presence. Director, Professors and teachers, I most heartily congratulate you on the result of your labour.

“Mr. Holderness, Ladies and Gentlemen.—The idea of the establishment of an Imperial Forest School was conceived in 1878, by Sir Dietrich Brandis, who has the distinction of being the originator of scientific and systematic forestry in India, and in whose footsteps we all follow as humble disciples, each according to his light. Before his time all was chaos. We must never forget the originator nor the labour of those who helped him to found the school, and those who assisted in its first development, such as Colonel Bailey, R. E., and Mr. Fisher. The school was started in a small way, but even in its earlier days turned out many a good and useful forest officer. Thus matters went on fairly satisfactorily for some years, when a critical event occurred in the history of the institution, which marks a new epoch. When I was on leave, in 1891, my friend Mr. Hill acted for me; and by some inspiration, of which I have always been extremely jealous, invented the Board of Control and introduced Mr. Gamble as Director. About Mr. Gamble, whose praises have already been sung by Mr. Hill in a more able manner than I feel competent to do, I could say a great deal, and still would never say enough, so I will confine myself to a few words. That he is a scientist of European reputation is too well-known to be repeated—and I can only say that amongst us he has built himself a lasting monument by the development of this school to its present high standard. Ladies and gentlemen, you only see the external evidence of his work, but I assure you that the kernel of the fruit does credit to its outside appearance. During my many tours in India, I have ample opportunity of judging of the merit of the officers turned out of this school—and find that the expectations originally formed of the results to be obtained have, if anything, been surpassed, and that the foundation has been laid at Dehra to the career of many a good, useful and practical forest officer. I am sure all Conservators agree with me in this.

"The formation of the Board and its annual visit to Dehra has also had a marked effect on the development of the school. The examinations conducted by it are by no means easy. They are searching, but they are just, and a continuous and fair average is being maintained. I dare say you students do not much enjoy the long string of conundrums which you are called upon to solve by the members of the Board. Whenever I visited the examination chambers, I must say you did not look as if you did—and I sympathised with you. It was, however, a great source of pleasure to me—and to the others who witnessed it—to see the boisterous delight with which you received the news of your success. It showed to us the vigorous health of your youthful bodies. I am a great believer in *mens sana in corpore sano*, and it is for this reason that I am in the habit of giving a prize to the best athlete. I have never been able to think of a proper test, or I should have given another prize for the best general health, and, more especially, for the best digestion. This is by no means a laughing matter, but one of great importance to you students in the first instance. It has happened before now that officers in our service have lost their way in the jungle, and for days have had to exist on forest produce and monkeys, and under such circumstances a strong digestion is by no means to be despised. It is also of great importance to the State which employs you, that you should start your career in good health and keep it. I can but wish that each and all of you, after a happy and successful service, will receive from Government a long continued superannuation pension, a prize which, without a good digestion, nobody in the forest service can hope to obtain. Students of the first year, I can only urge you to emulate the achievements of your seniors, and, if possible, to surpass them. Ladies and gentlemen, I thank you for your presence; Mr. Holderness, allow me also to thank you for the honour you have done us, and to beg of you to distribute the prizes."

Mr. Holderness then rose and gave the following address:—

"MR. HILL, LADIES AND GENTLEMEN.—I accept with great pleasure the agreeable and honourable office which the Director of the School and the Board of Control have been good enough to assign to me, and I desire to express my thanks to you all for the very kind welcome which you have given me. I stand here in the unfortunate position of being a stranger to you and of being only a visitor to your beautiful valley. But the embarrassment which results from this untoward circumstance has been greatly, I might even say wholly, removed by my friend, Mr. Kibbentrop, who has acted as my sponsor. I feel, at any rate, that my references are exceptional and my introductions good. I am also grateful to

my friend for having, by his eloquent and most instructive address, so materially lightened my task; I am not sure in fact that he has left me anything to say. But I should be doing injustice to the school, and to my own feelings, if I were to omit to say something as to the excellent work which the school is doing, and the excellent example it is furnishing to the cause of education in India. Mr. Hill has told us that the Dehra Dún Forest School has this year attained the ripe age of 21 years. Compared with the hoary antiquity of our great schools and colleges of England, the Dehra School is still in one sense in its veriest babyhood, or has certainly not emerged from the nursery. But if we judge the school by results, we shall see that in these 21 years it has travelled fast and far. It has gathered up a multitude of experiences. It has tried its experiments and had its successes and disappointments. And in the period it has probably registered a greater advance than many a venerable institution in a century.

"The problem which the wise men who founded the Forest School had to attack was this. The business of forestry has its two aspects. The one aspect is practical, the other theoretical. The commercial management of a forest is an intensely practical matter. But if this management is to be successful, it must be based on a sound scientific knowledge. Thus, a good Forest Officer has to be both an active, practical, observant man; and also a man well versed in various branches of science. For the superior staff of the Forest Department there was no difficulty in obtaining the proper material in Europe. But the superior staff of an army can do very little, unless it has a good army and good subalterns at its disposal. For many reasons it was clear that this subordinate agency for the Forest Department must be sought in India. It was out of question to import it. But when the heads of the department looked about them in India, they were unable to find any school or college which gave to its pupils an education fitting them, either practically or theoretically, for the business of forestry. Consequently, they had to devise a school which should give this mingled practical and theoretical education, and turn out a reliable and intelligent forester or ranger or sub-assistant conservator. As usual there were not wanting persons who prophesied failure. Such birds of ill-omen are not uncommon. They said that the native of this country had no natural aptitude for forestry. They also said that the school would turn out nothing but conceited theorists and pedantic book-worms, and that the conditions of forest service and the character of the work would not draw to the school the proper stamp of lads from the regular schools and colleges.

"I rejoice to think, and I am sure you also rejoice, that these prophecies have been absolutely falsified in the result. The report, to which we have been listening, shows that the school does obtain the right class of candidates. The verdict of the Board of Control, which is a very independent and critical body, is most satisfactory as to the excellence of the teaching and the progress of the scholars. Mr. Ribbentrop informs me that he is more and more impressed, in the course of his tours of inspection, with the thoroughness of the practical work of passed students, and with their capacity for the responsibilities and duties placed upon them. Now, in a matter of this kind, Mr. Ribbentrop's opinion is a tower of strength: I may say, that it is conclusive. Mr. Ribbentrop has been described by one of his friends with sporting proclivities as the best judge, *bar none*, of a tree in India. He is also, if he will permit me to say it, a good judge of men. If then Mr. Ribbentrop is satisfied with the class of men the school is turning out, we need have no doubt but that the school instruction is on the right lines and is fulfilling all the expectations of the wise men who planted it, and the wise and kindly hands who have nursed it in its vigorous youth. When so many have contributed to this good result, it is perhaps invidious to particularize names. But Mr. Gamble's recent retirement, and his long connection with the school, make it impossible not to refer to him on this occasion. We know that he has in every way a most worthy and competent successor in Mr. Hill. But Mr. Hill will, I feel sure, say that he would not have been able to give us the present excellent report of progress and success, had Mr. Gamble not preceded him in office. In other words, the school is now in a very different state from that of the school which Mr. Gamble some years ago took charge of. We hope and trust that in his retirement Mr. Gamble will continue to give Indian Forestry the benefit of his unrivalled botanical knowledge. In the continued prosperity of the Dehra Dûn Forest School he will find one of the most pleasing mementoes of his Indian career.

"I feel, ladies and gentlemen, that I have detained you an unconscionable time, after having commenced with the statement that my worthy friend, Mr. Ribbentrop, had left me little to say. Before I proceed to distribute the prizes, I would like to say to the students that I have listened with great pleasure to the excellent report which the Director has read to us. It shows that they have done very good and meritorious work. I confidently hope that their work in the department will not be less meritorious and praiseworthy."

After the distribution of the certificates, medals and prizes, the proceedings were closed with loud cheers for Mr. Holderness, Mr. Ribbentrop, the Board of Control, the Director, and the visitors.—*Pioneer*.—5th April 1899.

Timber Seasoning by Electricity.

We extract the following from the *Engineer*.

During the last few years considerable attention has been given to the invention of new processes for treating timber. The latest aspirant to fame is a process and apparatus which claims to give to timber properties which time alone has so far been able to produce. It is a French idea, and has, we are informed, met with considerable success in Paris, where works have been established to treat timber on a large scale. The Nodon-Bretonneau process involves the expulsion of the sap and its replacement by a solid matter, insoluble and aseptic. This is effected by placing the material to be treated in a vat containing a lukewarm solution made up of borax, 10 per cent; resin 5 per cent; and .75 per cent. of carbonate of soda. While in this bath, an electric current of about 100 volts pressure is caused to pass through the timber. The current sets up what is termed electro-capillary attraction, and drives out the sap by the introduction of the solution. This treatment lasts from six to eight hours generally, after which the wood is subjected to a further treatment of a few hours' duration in a warm bath to allow of thorough permeation of the entire section. It is then removed and dried under cover by air currents, a process which is said to take from fourteen days to a couple of months, according to the density and thickness of the material. The inventors claim that not only is a considerable saving in time and expense in the drying of timber effected by this process, but that certain classes of wood, such as maritime pine, which have not hitherto been readily saleable owing to the large amount of moisture they contain, can by its use be readily deprived of the sap. The expenditure of electric current is said to be 600 watts per cubic metre per hour for five hours. The Electric Timber Seasoning Company, Victoria-street, Westminster, is introducing the system into this country, and a model apparatus has been fitted up at the works of Messrs. Johnson and Phillips, Charlton Junction.

Village arborescent Plantations.

TO THE EDITOR,

SIR,

The soil over large areas of India, when cultivated for a long period of time, without being adequately manured, becomes almost non-productive, only able to maintain a sparse population, perhaps none. Then it has rest. In the course of time tufts of grass spring up, then shrubs, then scattered trees from

seeds dropped by passing birds or carried by wind and water, then jungle. After that come people from other neighbourhoods in search of suitable land to settle upon, they obtain a patta, or cultivating lease, at a moderate rent, they begin to cut down the trees, burn the brushwood (the cause of many devastating jungle fires), plough the land, sow their seed, reap their harvest, marry, increase in numbers, gradually denude the land of its arborescent covering, then use the stable manure, which ought to go on the ground, for fuel, not only for household purposes, but to burn bricks and ballast with, and so matters proceed until the soil becomes worn out, unable to sustain population, the rainfall becomes irregular, famine stalks abroad, the inhabitants die or remove to some more fertile spot, then the soil has rest, and so on throughout the centuries. It is nothing more than the careful farmer's method of allowing part of his cultivation to lie fallow, only on a much grander scale. Nature will not be cheated out of her dues; she is a good friend but an implacable foe; be just to her and she will reward you, return to her what you take from her and—extraordinary convulsions apart—you will receive her utmost consideration.

The Government officials write reports, minutes, correspond with arboricultural societies all over the world, establish forest plantations at great cost—more suited for the well-to-do classes than for the labouring millions, and then wonder why so little good comes from their efforts. It is because they try to lead nature instead of assisting her in the only suitable manner, viz, by forming village arborescent plantations all over the country—where required—so that the people may have cheap wood-fuel (coal is too scarce, expensive, and unsuitable to their requirements under present circumstances), and be enabled to utilize their stable manure for their fields instead of using it for cooking purposes. In the course of a few years, climatic conditions will become changed and more bearable, and the rainfall more equable. They will yield a continuous supply of timber for building and kindling wood, the loppings of the boughs (in moderation), thinnings, and a portion of the fallen leaves (sufficient being left to form humus), will serve partly for household purposes and partly for bedding for their cattle, and afterwards would be spread over the fields for manurial purposes; the grass, for food for their cattle, to be mown, not dug up by the roots according to the custom in some places; if some of the trees are fruit-bearers, then there will be fruit for the families, and thus in all respects the villagers will live more comfortably than at present by approximating to nature and helping her instead of being antagonistic, as they now are, from causes beyond their control.

Surrounding the villages or mixed up with the cultivated areas or within their boundaries, more or less proximate, are

patches of waste land, denuded of humus and bearing only a few scattered trees, reeds, and blades of grass, over which the cattle wander day by day endeavouring to eke out a subsistence, poor at the best and only obtainable by needless exercise, causing an unnecessary waste of tissue to obtain their scant meals. It is a portion of this now unculturable land which can be converted into tree-bearing tracts without detriment to any one.

The cost to Government will be slight, as the personnel is already in existence in the shape of the village panchayet (council of eldersmen, generally five in number) to direct, and the villagers to carry out the work in their spare time between ploughing, sowing, and reaping, and other occupations, on the usual *begari* system in operation from time immemorial; it will cause no hardship, as the benefit will be theirs. The map lists of each man's holding, occupation, and all other information are in the hands of the district or settlement officials (copies being in the villages for ready reference) who have a staff of native surveyors. All arrangements (simplicity in themselves) should be made subject to approval of the district officials, and occasional advice of any officer of the Forest Department when travelling in the neighbourhood, leaving as much to enclosing and nature as possible.

The members of the plantation panchayet should be elected for three years, the senior member to vacate and a new member to be elected. For the first five years the routine will be out of the regular course, but after that period the proper rotation will be established. No passed member should be re-elected until all the villagers have served on the plantation council, thus ensuring just distribution of produce to all concerned.

The chief business to be attended to, after demarcating the portion of land to be used for this purpose, is to enclose it, so that cattle cannot wander over it and thus prevent the growth of vegetation. Nature may be assisted by ordinary ploughing and scattering suitable seeds, sparsely, and leaving the rest to time. If there is any water at hand to spare, irrigation will produce quicker results. But enclose, keep the cattle out, and nature will do the remainder of the work.

Without any inconvenience, under present circumstances, to the villagers, about one-third of their unculturable land might be taken up for this purpose, it need not be in one block but in different places, and then it should be enclosed for thirty years, the period required for ordinary trees to arrive at maturity.

The unculturable village land could be divided into three divisions A., B., C.

About the twelfth year the saplings in division A will have been thinned out to ten feet apart, when the village cattle may be allowed to graze under proper supervision of their owners for two or three hours on three days in the week, the

length of time increasing every year, as the trees increase in size. From this time forward the trees would be felled only in accordance with the actual requirements of the villagers, and by permit, from the plantation panchayet. And this method would go on until the expiration of thirty years when the enclosed tract, division A, would be thrown open to the villages, and division B would be taken in hand and treated in the same way, then division C, after which, division A would require re-habilitating (and so on throughout the centuries) but not so much as on the first occasion, for the villagers having learned the benefit of taking care of the unculturable land, would prevent unnecessary damage to the arborescent vegetation. In this manner the villagers will have a supply of forest produce for as long as their village remains on this site.

If considered advisable to expedite matters, the division could be thrown open at lessened periods of time with suitable precautions, to prevent undue destruction of the trees.

From the earliest possible safe moment, after enclosing, the villagers should be allowed to cut grass with a sickle, not root up with a *khurepa* (like a blunt trowel), and use the annual thinnings of the saplings and the loppings of boughs, but no animals to be admitted except in the manner already mentioned.

All supplies of plantation produce for the villagers to be free in return for their care of their arborescent plantations. Should any be sold to outsiders for brick or ballast burning, building or other purposes, the money to be equally divided among all the villagers. Care to be taken that the poorer villagers, are not cheated out of their proper proportion of produce from their arborescent plantation. One-tenth of the area to be always maintained under trees.

Shrubs and small trees, not throwing much shade over the crops, should be grown wherever practicable in the little patches of waste ground and borders of fields to help retain moisture from rainfall. Obtain as much arborescent vegetation as possible to attract moisture from the clouds and yield it up by slow degrees.

The advantage of such a method of reboising the land is that it can be carried out all over the country where necessary, simultaneously, and at very slight cost to the Government or to the people, and as a grand adjunct to the ordinary operations of the Forest Department.

Its success will depend on the interest taken by the District officials.

It could have been initiated several years ago, and by this time immense areas of non-productive land would be under a young growth of trees, fifteen years old at least, yearly increasing in size, and the rainfall may have become so much more equable that the famine of two years ago would not have attained the intensity that it did.

The Famine Insurance Fund is a wonderful idea in theory, but impracticable in application.

Famine relief-works are incapable of benefiting any but the able bodied inhabitants and lead to more venality than good.

Canals are useful for crops requiring to be largely irrigated, like rice, and where the surplus water drains off into a neighbouring stream, otherwise the land becomes water-logged and useless, except by artificial drainage. Without manure to put on the land, they sterilise it with silex brought down in suspension by the water. Canals are more suitable for traffic.

Well water is the best irrigant, and a large portion of the money spent on canals would have yielded better results to the villagers if it had been laid out in sinking wells having improved lifting apparatus.

Railways have proved highly useful as distributors, and will increase in utility as they increase in length. But arborescent village plantations, intelligently maintained, are the best preventatives against famines.

(Sd.) GEORGE P. PAUL.

NEW YORK,
November 29th, 1898.

(Agriculturist).

Flowering of Bamboos.

The flowering of *Bambusa arundinacea* is reported, by the Extra Assistant Conservator in charge, to be general this year in the Angul Division of the Bengal Presidency. The seed is expected to ripen shortly.

The price of Padaku.

An occasional correspondent writes to inform us that the Trade circulars, in which the price of *Padauk* in England is quoted at 3 shillings a cubic foot, very much understate the price which that wood now commands. He tells us, on unmis-takable authority, that 1,600 tons of best red Andamans, *bois de luxe*, padauk have been sold in advance at 6 shillings and 6 pence per foot; and that, if more were available, considerable quantities could be at once disposed of at that remunerative rate.

VIII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

March 2nd, 1899.

EAST INDIA TEAK—The deliveries for the first two months of this year amount only to 3,713 loads against 5,257 loads in the same period of 1898, the figures for February alone being 1,373 loads against 2,770 loads in February last year. The Dock stock is down to 10,000 loads, and prices are very firm.

ROSEWOOD—**EAST INDIA**.—The demand is good, and shipments being moderate are readily placed at full rates.

SATINWOOD—**EAST INDIA**.—The stock is sufficient, the chief demand being for figury wood.

EBONY.—**EAST INDIA**—Wood of good colour and sizeable in small lots, would realise fair prices.

PRICE CURRENT.

Indian Teak	per	ton	...	£11 15s.	to	£16 15s.
Rosewood	"	"	...	£9	to	£11
Satinwood	"	sft.	...	5d.	to	12d.
Ebony	"	ton	...	£6	to	£8

Denny, Mott and Dickson's Wood Market Report

LONDON, 1ST MARCH, 1899.

TEAK.—The landings in the docks in London last month consisted of 199 loads of logs and 58 loads of planks, against deliveries into consumption of 859 loads of logs and 618 loads of planks. The dock stocks at date analysed as follows:—

8,992	loads of logs,	as against	12,097	loads at the same date last year.
6,544	" planks	"	3,255	" "
28	" blocks	"	20	" "
<hr/> 10,564 loads		"	<hr/> 15,372 loads.	

The falling off in the landed stock of logs is fully 42 per cent. as compared with the figures at the same date last year, and this fact, in conjunction with the growing demands of the shippers, both in Burmah and Siam, sufficiently justifies the very firm attitude of all holders of stock, as it is felt that present rates on this side are low when compared with the likely cost of replacing stocks.

Business during February was of a quiet but steady character, and prices generally hardened owing to the firm attitude of all holders of timber at the sources of supply, pointing to the probability of merchants and dealers on this side having to replenish stocks at an advance on last year's generally high import values.

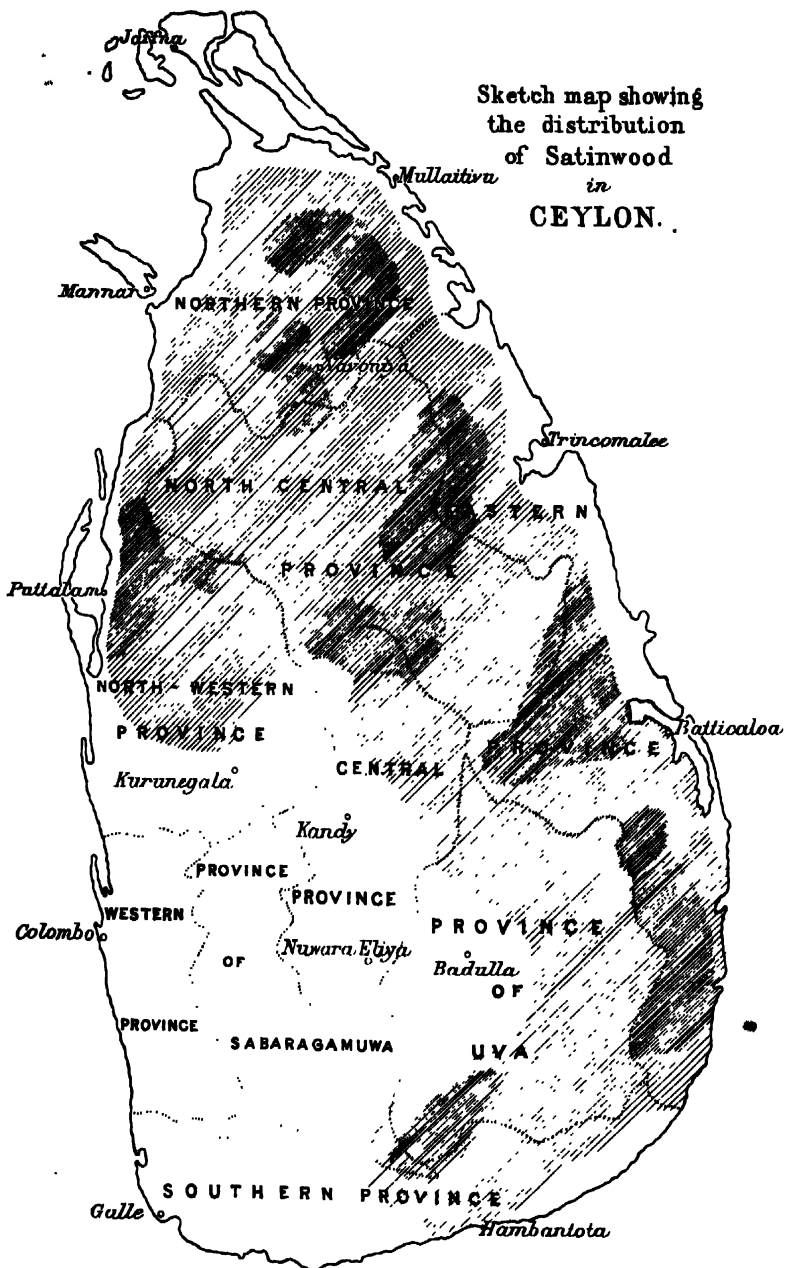
MARKET RATES OF PRODUCE.

Tropical Agriculturist.

March 1st, 1899.

Cardamoms	per lb.	2s. 9d.	to	3s.
Croton Seeds	„ cwt	55s.	to	70s
Cutch	„ „	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras	„ „	32s. 6d.	to	40s.
„ Kino	„ „	65s.	to	75s.
India rubber, Assam	„ lb.	2s. 9d.	to	3s. 3d.
„ Burma	„ „	2s. 9d.	to	3s.
Myrabolams, Madras	„ cwt.	5s.	to	5s. 6d.
„ Bombay	„ „	4s. 3d.	to	9s.
„ Jubbulpur	„ „	4s. 6d.	to	8s.
„ Bengal	„ „	3s. 6d.	to	5s. 6d.
Nux Vomica	„ „	8s.	to	10s.
Oil, Lemon Grass	„ lb.	3d.	to	3½d.
Sandalwood, Logs	„ ton	£30	to	£50.
„ Chips	„ „	£4	to	£8.
Sapanwood	„ „	£4	to	£5. <i>Nom</i>
Seed lac	„ cwt.	55s.	to	62s. 6d.
Tamarinds	„ „	4s.	to	6s.

Sketch map showing
the distribution
of Satinwood
in
CEYLON.



N.B. The more important forests are indicated by denser shading.

THE INDIAN FORESTER.

Vol. XXV.]

May, 1899.

[No. 5.

Satinwood.

CHLOROXYLON SWIETENIA D. C.

Brandis in his "Flora of North-West and Central India" thus speaks of this tree :—' A common tree in the Satpura Range, the Dekkan, the Konkan, and the drier parts of the peninsula and Ceylon. A small tree in Central India, in South India attaining 30-40 ft ; trunk straight, symmetrical. Bark yellow, soft, corky, $\frac{1}{2}$ in. thick or more. Heartwood, with a beautiful satin lustre, fragrant, when seasoned, greenish white with a yellow tinge, or yellow, mottled, and feathered, close grained. Heavy, the cub. ft. weighs 51-66 lbs. when seasoned, and 70-75 lbs. when green. The value of P. has been found to fluctuate between 600 and 1059, and the average may be taken at 800. Has been compared to box, not found suited for engraving, but is excellent for turning. Employed for agricultural implements, cart-building, makes beautiful furniture and picture-frames. Imported into England, used for cabinet work and the backs of brushes."

My experience of Satinwood in India being most limited, my remarks apply mainly to this tree in Ceylon, where it attains its best dimensions.

Distribution :—The annexed sketch map shows, roughly, the distribution of this tree over the island. It will be seen that it is only absent from the South-Western portion, *i. e.*, from the portions affected by the South-Western monsoon, and from the higher mountain ranges. I have seen some trees at an elevation of about 1500 feet in the Province of Uva, and a few trees in the intermediate rainfall zone near Kurunegala, but, as a rule, it can be said that it is not found above an elevation of 800 feet, and in localities with a rainfall of over 65 inches. The finest forests are in the Northern portions of the Batticaloa District, and in the Puttalam District. In the Northern portion of the island, the trees, although abundant, do not attain very large dimensions.

Soil:—Satinwood requires a light sandy soil with good subsoil drainage. It is also found on well-drained rocky hills, if there is not too much clay in the soil.

Sylvicultural requirements:—This tree is essentially a shade-avoiding tree, except perhaps in its infancy when, like other trees, belonging to the natural order of the Meliaceæ, it prefers side-shelter or low cover. It springs up readily in clearings, but is also found along the sides of forest roads and lines or growing in the midst of bushes in old clearings abandoned by the chena cultivator. In this respect it is a valuable re-afforesting agent; for, after the chena cultivator has cut and burnt off the jungle and cultivated it for two or three years, a rank growth of spiny and prickly bushes springs up, which the Satinwood helps in again becoming valuable forest. In high forest, especially if the leaf canopy is not dense, or if it is not high, Satinwood seedlings germinate readily enough, but they require the aid of man to develop into trees. It is for this reason that in Ceylon forests of a certain age, although large and medium-sized trees are not uncommon, there is a remarkable absence of saplings and poles. This has led Mr. Vincent, in his valuable Report on the Ceylon forests, to state that the natural reproduction was poor. The contrary is, however, the case; but up to recently the Government did not do anything to replace the trees taken away by helping the young seedlings, and no cleanings or seed-fellings have been carried out. It appears to me that the correct treatment for Satinwood is to girdle trees for some distance to leeward of the seed-bearers, in sufficient numbers to give light to the soil without encouraging the growth of rank grass and weeds, and far enough to let the light seed, which is carried to some distance by the wind, have a chance of developing into seedlings. As the seed ripens before the North-East monsoon, the girdling should be done early in the year, and at the same time all large climbers which invade the crowns of the trees should be cut. After the seed has germinated and the seedling established itself, it requires direct overhead light, and this should be provided, but caution must be exercised in not girdling too many of the dominant trees, for this might lead to an invasion of insects which would be liable to attack the seedlings as well as the girdled trees.

Dimensions and rate of growth:—Satinwood grows to a large tree, except in wind-swept localities near the sea, where it attains only small dimensions. The crown is large, as can be expected with its light, feathery foliage; the bole, although it attains a girth of 8 or 9 ft. is usually comparatively short, i. e., rarely over 30 feet in height. This is due to the requirements of light by the tree which early forms branches in order to develop a large crown. As regards the rate of growth of the tree, the data which we have at present are unfortunately

not very reliable on account of the small number of trees in each sample plot and in consequence of the habit of mixing up trees of different girth-classes, and of calculating the average girth for all. This method of measurement has now been given up and the trees are measured by girth-class, and it is hoped that in a few years reliable data will be obtained. I have gone carefully into the figures available and the following appear to me to give a fairly correct idea of the rate of growth of an average Satinwood tree.

Age of tree 18 inches in girth	...	20 years.
" " 3 feet	...	45 "
" " 4 ft 6 in.	...	75 "
" " 6 feet	...	125 "

If this estimate of the rate of growth proves to be correct, it takes 50 years for a tree 4 ft. 6 in. in girth to reach a circumference of 6 feet. If, therefore, the exploitable size is taken at 6 ft., as it is now in Ceylon, it would be proper under the Selection Method of treatment to go over the forest in 50 years, taking all the trees 6 ft. and over which can be spared from a silvicultural point of view. In old forests, it would be better still to go each year, on an average, over one twenty-fifth of the area, taking only one-half of the exploitable stock or confining operations to trees whose removal is most urgent.

We have not yet sufficient experience to know, in the event of the Regular Method being adopted, how many years before the final fellings the seed-fellings should be made. Observations made in our forests since 1891, show that the Satinwood flowers abundantly every year and it is probable that seed-fellings made some 7 to 10 years before the final fellings, would give a good crop of seedlings.

Enemies.—This tree, like others belonging to the same natural order, is liable to attacks from insects which bore into the pith of the young shoots. A large number of trees die from the attacks of the larva of a beetle, probably a longicorn, which makes galleries between bark and wood, that not unfrequently girdle the tree. The young saplings are very liable to injury by stags, since these prefer them to any other trees for rubbing off the velvet from their horns. This preference is probably due partly to the corky nature of the bark and partly to the gum, which exudes from wounds and soothes the irritation which the animals feel. In some parts of the island the trees are liable to the attacks of a fungus, which rots the centre of the tree and causes a clean hole, sometimes throughout the length of the bole. This is the case particularly in the South-Western portion of the island. Satinwood does not resist fires well.

The timber.—The weight of 12 well-seasoned pieces taken by me from different parts of the island, varied from 55.2 lbs. to 65.4 lbs. per cub. ft., and the average was 59.92 lbs. per cub. ft. This is a somewhat higher average than that of the specimens

tested by Mr. Smythies in 1878, which averaged 57 lbs. Seasoned wood can, therefore, be said to be lighter than water. The wood is hard and strong, takes a beautiful polish, and is extremely durable. The most valuable wood is that which is known in Ceylon as "flowered," and in the home market as "figury" wood, especially if it is light-coloured and can be used together with West Indian Satinwood. The price of flowered Satinwood in Colombo ranges from Rs. 4 to Rs. 7 per cub. ft. in the log. It has not yet been ascertained what the figure in the wood, which is merely curly fibre, is due to, and whether it is hereditary. It was found in some abundance in one of the forests of the Pattalam District, which was exposed to the full blast of the monsoons and wind may have something to do with it, but I think that it must be due also partly to the soil. There is streaky and curly flower, and it is the latter which gives the prettiest effects of satin-like lustre and which fetches the best prices in the market. Unflowered satinwood fetches prices up to Rs. 2.50 per cub. ft. according to colour and size of the logs. Light-coloured logs are preferred although the darker ones are better for patching up old cabinet work. Logs of a dull, muddy colour are not appreciated. The best logs as regards colour and size are now obtained from the forests in the East of the island. Fine logs used to be obtained from Pattalam, but these forests have been more or less exhausted by timber traders in the old days. The finest logs I have seen were 8 to 9 ft. in girth.

The logs for the home market are sent to the Central Timber Depot in Colombo, where they are tested for "flower," and the flowered logs set aside. Hitherto they have been sold according to market rates; but in future, on account of the great demand for flowered logs, the latter will be sold by auction. The proportion of flowered logs is not much above 5 per cent. Satinwood is also sold at the Forest Depôts or, when possible, standing in the forests. This has been the case in the Eastern provinces, where first class logs have been stamped over one-sixtieth of the area, but the sale of the *coupes* was effected after the picked logs had been felled and sent to Colombo.

The strength of the wood has not yet been tested with pieces of a proper size, the largest specimens tested having, according to Gamble, a cross-section 2 in. square. I have not much faith in tests made on pieces of timber which may be taken from any part of a log, and should like to see the example of the University of Sidney followed, where Professor W. H. Warren tests pieces of timber of the dimensions ordinarily employed for construction. According to Gamble the value of P. varies from 504 to 1,059, but I think that, on an average, it will be nearer 1,000 than 500,

The uses to which this timber is put in Ceylon are the following :—

Cabinet work and furniture. Satinwood furniture is, however, heavy; and is really suitable only when finely made, as in the case of Chippendale patterns. In cart-building it is used for the naves and spokes of heavy carts. It has been much used for house and bridge building, and the bridge at Peradeniya, near Kandy, consisting of a single arch 205 ft. wide, is built entirely of this wood. Ball-room floors made of Satinwood are considered good, but to my mind they are too hard, wanting in elasticity and much too slippery for dancing. Sleepers made of this timber have lasted over 20 years on the Ceylon Government Railway, and experiments are now being carried out in the new Colombo Harbour-works to test its resistance to the *teredo*. The pieces have only been put in position a year ago, but so far they are intact. In the North of the island the wood is used for oil mills; and in the Eastern province, hollow logs are in great demand for wells. Ploughs are usually made of this wood.

Minor products.—According to the Dictionary of Economic Products, this tree yields a yellow dye and a wood-oil. I have, however, never heard of these products being employed in Ceylon. The bark, like that of other *Meliaceæ*, has medicinal properties, and a gum exudes from it which might prove to be a good substitute for gum arabic.

COLOMBO :

28th March, 1899.

A. R. BROUN.

The treatment of Bamboo Clumps and Bamboo Forest.

This very important question is one which has been much discussed, and which requires to be permanently settled. But the first point of importance, which must precede all further discussion of the question, is one which has sometimes been overlooked. That point is that, in order to be able to make one's mind clear as to the data upon which to speak or write, we must give up talking of "*the bamboo*" or "*bamboos*" generally and restrict ourselves to a consideration of each species on its merits. In a recent paper on the biology of Indian bamboos (*Indian Forester*, January 1899) Sir D. Brandis writes ;— " To talk of the habits of bamboos

‘and of the management of bamboo plants, has little meaning and is of no practical use. Each species has its own ‘peculiarities and its own requirements.’ No one, who has any acquaintance with the chief species of our Indian forests, would think that the same treatment can be applied to the densely caespitose, interwoven clumps of *Bambusa arundinacea* or *Dendrocalamus strictus* and to the open separately-stemmed forests (for the term “clumps” is here inapplicable) of *Melocanna bambusoides* or *Arundinaria racemosa*.

Bamboos, thus, in India as shown by Sir D. Brandis, may be divided into two classes:—

- (1) Those with short thick rhizomes which form regular closely-growing clumps.
- (2) Those with long, underground, thin rhizomes which send up isolated stems.

In (1) come such important species as:—

Bambusa Tulda
 „ *Balcooa*
 „ *polymorpha*
 „ *arundinacea*
Dendrocalamus strictus
 „ *Hamiltonii*
 „ *Brandisii*
 „ *giganteus*
Cephalostachyum pergracile.

while in (2) come especially:

Bambusa nutans
 „ *burmanica*
Gigantochloa macrostachya
Melocanna bambusoides

The bamboos of class (2), of which the commonest and best known kind is *Melocanna bambusoides*, the “Muli” of Eastern Bengal, and the principal one of those known as “Tabendcinwa” in Burma, as recently ascertained from specimens sent by the Conservator of the Pegu Circle, do not grow in regular clumps, but spread themselves over the country. Their treatment, therefore, seems to present no difficulty, except that I should think it would be advisable to restrict cutting to culms of one year old and older.

It is in the treatment of bamboos of class (1) that a difference of opinion has existed, and it is in regard to the chief forest species, viz., *Dendrocalamus strictus*, that the discussions have taken place.

Dendrocalamus strictus, the “male bamboo,” is the sole indigenous species in the Siwalik Hills and Lower Himalayas of the Punjab and North-Western Provinces. It also occurs in large quantity right down the Western Peninsula, through the Central Provinces, Orissa, the Circars, Carnatic, Deccan and

Maharatta country ; it is absent from the greater part of Bengal and from Assam, but is found again in profusion in the forests of Burma, where it is known as "Myinwa." My own experience of it has been gained in Chota Nagpur and Orissa, in Bengal, and in the Madras Presidency, as well as in my present charge, the School Circle, N. W.P. and Oudh. In Bengal it is worked from forests almost pure in the Palamau Division, and especially from the Kechki and Betlah Reserves. In Madras it is most largely worked in the forests of the Godavari, Kurnool and Cuddapah Districts. Here, in the Saharanpur and Dehra Dún Divisions, as well as in the adjoining Ganges Division of the Central Circle, it is perhaps the most important of all the products of the forests and the most valuable. It is, therefore, very necessary that its treatment should be understood and applied so as to lead to the largest production compatible with the improvement of the capital stock. The subject has consequently received great attention and has been discussed considerably, especially in reference to the preparation of Working Plans for the Dehra Dún, Ganges and Saharanpur Divisions.

In the Working Plan for the Dehra Dún Division the prescriptions were, that, if the work were done departmentally, all shoots under two seasons old should be left, and if by sale to purchasers, at least 8 shoots should be left of saleable dimensions. This was revised in 1892 and the forests divided into three sections.

- (1) Three blocks to be worked departmentally, together with the cleaning out of all congested clumps.
- (2) One block to be worked on permit for Hardwar basket work supply
- (3) The rest to be worked on a 2-years' rotation.

The time has now come, I think, to carry out the "cleaning" if possible throughout the forests and to substitute annual for biennial thinnings thereafter. The cleaning work has not been very well done. In Johra it has been overdone, but I think the clumps will recover though the thinnings for the next few years will be poor.

The Working Plan for the Ganges Division, prepared in 1888 by Mr. N. Hearle, contains in paras. 59 to 74 a long and interesting account of the bamboo forests and the systems of treatment to which they had been subjected, with a discussion of the arrangements for future working. The provisions are not very clear, but simply amount to the recommendation of yearly thinnings if possible, and if not possible, of working on a 3 years' rotation. The plan was revised in 1896, and in discussing the question of the best system to apply, and a strong recommendation made by Mr. A. G. Hobart-Hampden that the thinning of bamboos should be done yearly, the Conservator

of the Central Circle consulted me on the subject, and in reply I wrote on the 6th February 1896 (see page 76 of Inspector-General of Forests Proceedings for March 1896), giving my opinion and the history of my endeavour to improve the condition of the clumps in my Circle. That letter fully disposed of the general question as I understand it, but since 1896 we have progressed a great deal in the Saharanpur Division, and we are now gradually "cleaning" all the clumps with a view to introducing everywhere the system of annual "thinning," and instead of having to pay for this cleaning, as I wrote in 1896 to Mr Dansey, we can now make the work a profit to Government.

In the Saharanpur Working Plan the prescriptions are given in paras: 67 to 76 and the arrangements are these:—

- (1) Working the Maiapur Block for green bamboos for the Hardwar basket makers.
- (2) Working 6 Blocks on yearly thinnings after a preliminary cleaning.
- (3) Working the rest on biennial permits, the purchasers to cut under regulation, but if possible, the arrangement to be gradually changed to annual thinnings.

It was in the Ranipur Block that cleaning was first attempted. By a mistake many clumps were clean-cut so that they produced at first only thin shoots. The greater part of the bamboo area is under a Coppice Working Plan, and the result of the coppicing of the trees has been to give more light to the bamboos, so that they bid fair soon to almost monopolize the area. This is a good thing, as fuel is to be had in plenty from the hills behind, while the bamboo is much more valuable. The cleanings are being gradually carried out and in many clumps yearly thinnings are now in progress. Appended is a memorandum by the Divisional Officer, Babu Karuna Nidhan Mukerjee, on the system under which the cleanings in this and other Blocks are being done. It will be seen that the operation is being now made a source of revenue.

In my letter to the Conservator, Central Circle, already referred to, I described the work done at the Forest School with certain clumps there. This work has now been going on for several years, and I have watched the results very carefully. I have no hesitation in giving it as my opinion that the cleaning, followed by yearly thinnings, has:

- (1) increased the number of yearly shoots;
- (2) improved the quality of the shoots, which have now space to develop straight and healthy;
- (3) allowed of the removal, at will, of any single shoot or culm that it is desired to cut;

and I cannot help surmising that, under this system, the year of flowering can be postponed, perhaps indefinitely. Of course, it is not to be supposed that work in many square miles of forest can be carried out as neatly and carefully as it is in the Forest School Park, where the work is done by men who understand it fully, and with the saw instead of the axe; but without such neat working, a great deal can be done which will serve equally well.

That I am not alone in believing that annual thinnings are the best way to treat clumps, *i.e.*, forests of *Dendrocalamus strictus*, is clear from the remarks made by others who have studied the subject, such as Mr. E. E. Fernandez in his paper in the "Indian Forester," Volume XVII, page 186; Mr. Hobart-Hampden in his letter to the Conservator, Central Circle, in Inspector-General of Forests' Proceedings for March 1896, above quoted; Mr. N. Hearle in his Ganges Working Plan, and Mr. Dansey in various places, and last of all in his Annual Report for 1895-96, para. 100, copy of which is appended. In that extract, he considers that the possibility of the clumps flowering and dying off immediately after cleaning, is sufficient to condemn cleaning. There might, in my opinion, be something to be said for this view if the cleaning were expensive, but, as Babu Karuna Nidhan Mukerjee has now proved that it can be done profitably, the objection must fall to the ground.

The sum of my experience goes to show that in the treatment of large areas of valuable bamboo (*Dendrocalamus strictus*) forests, like those of the Saharanpur and Ganges Divisions in the N.-W.P.; of the Palamau Division in Bengal and of the Godavari Division in the Northern Circle of Madras, which I believe are the areas where there are the largest compact forests, near the market and easy of access and export, the first thing to do is to endeavour to bring the clumps gradually, by means of a "cleaning" of dry wood, old stumps, twisted and crooked culms, trees, bushes and climbers into a condition, in which the culms are fairly equally spaced throughout and each individual capable of being reached and cut without injury to the rest. This cleaning may with profit be done, as Babu K. N. Mukerjee does it, in connection with the yearly thinnings, so that the persons who carry out the work have an interest in it and are not liable to lose financially. If for instance, $\frac{1}{4}$ th of the clumps in any given area, in which the right of cutting is sold, are "cleaned," it will take 4 years to do the whole. In this cleaning, where the clumps are *very badly* congested, there must be overcutting the first year, but I have not found that this does any great harm, if the treatment in after years is judicious. So far as is possible, the last year's and the two-year-old culms should be the chief ones left, and everything out should be cut to within 6 inches of the ground.

The next point of vital importance to remember is that, when a clump has been once cleaned, *annual thinnings* must be regularly made. I have known these thinnings omitted, because the Staff considered that rest was wanted after such severe treatment, with the result of a relapse into congestion. If the cleaning has had to be done very heavily, the next thinnings will naturally be light, but so made as to aim at bringing each clump into a condition, in which the standing culms are as regularly spaced as possible and all equally easily reached. In large forest areas, it is best not to attempt too much at once, but to do only that area which can be without doubt successfully done : the first few years' experience has to be gained ; as it is gained and the Staff gets to know its business, the work will become easier and eventually, I am sure, the results will be apparent in an enormously increased supply of one of the most important articles of produce to the people of this country and in a great increase of revenue. A decrease in the latter at first will only be natural, and should not be allowed to frighten us from the right way.

What I have here described for the male bamboo (*Dendrocalamus strictus*) may, I think, be applied equally to any other species of the clump-forming class ; but it must be noted that though *Bambusa arundinacea* was successfully treated by cleaning at Ballipalle in the Cuddapah District of Madras, in and about the years 1883 to 1888, this species is extremely difficult to clean, partly on account of its thorns and thorny side shoots, partly because the culms are weak and soft and unable to easily stand alone. But it is a bamboo of poor quality and its treatment by cleaning will be rarely attempted. In Burma, bamboos are usually too common and too much of a drag in the market for it to be worth while to adopt such measures, but there may be places where it is advisable to keep up pure, or nearly pure, bamboo forest for supply purposes, and perhaps cleanings and certainly annual thinnings will, I submit, prove useful with *Dendrocalamus strictus*, *Bambusa polymorpha* and even the "Wabo" *Dendrocalamus giganteus*. Again, in the forests of *Dendrocalamus Hamiltonii* in Northern Bengal and Assam, of which perhaps the ones I know best are those of the Kurseong Division in Bengal, annual thinnings, with the cleaning of dry and broken pieces, will probably be the best system of management. The species is, however, a poor one in strength and its habit of growth is very different to that of *Dendrocalamus strictus*, as the culms do not grow straight but curved and slanting and interlacing. In my opinion, wherever the forests are suited to it and the demand is sufficient, attempts should be made to replace it by planting *Bambusa Tulda*, *Bambusa Balcoa*, or other similar valuable kinds. I mention this, as I held the same opinion strongly several years ago, when I was Conservator of Forests in Bengal.

Memo. on thinning and cleaning of bamboo clumps in the Saharanpur Division, School Circle, N.-W. P. and Oudh.

Before the present Working Plan was enforced, the cleaning of bamboo clumps in the Ranipur and other blocks was done departmentally. In fact, contractors were employed to clean the congested clumps and thin out other clumps under departmental supervision. They were paid, not at daily rates of wages, but at fixed rates per score of marketable bamboos extracted, according to sizes, i. e., 10-ft. bamboos and *Bahis* at 2 annas per score. *Lathis* and *Punchis* at one anna per score, etc. This system was found defective, as the contractors were naturally inclined to pass over the congested clumps, the cleaning of which demanded most labour and from which a comparatively smaller quantity of marketable bamboos would be obtained. On the other hand, the contractors had a tendency to cut more bamboos than was desirable in the better clumps, simply to swell their wages without much labour. In 1895-96 I paid an extra rate of 3 to 6 pies per clump for those which were cleaned satisfactorily with a view to induce the contractors to do better work; but even this system was only partially successful. Besides, the difficulty of selling the bamboos obtained from the thinnings, with any profit or even at cost price, was great, and a large quantity deteriorated and had to be written off stock. A system of selling the bamboos direct to the contractors, who do the cleanings of the clumps, was, therefore, gradually introduced and this has been so far successful.

In 1896-97 the Working Plan was brought into force and since then the bamboo clumps have been operated on, by contract as a rule, with the following conditions:—

- (1) About one-third of the total number of culms are removed from the good clumps in such a manner that the remainder of the bamboos will stand apart from each other all over the clump.
- (2) No bamboo will be cut at more than 6 in. above ground.
- (3) As a rule, no bamboo less than a year old will be cut except where this is necessary for improvement of the growth.
- (4) The congested clumps will be cleaned without any regard to the number and kind of bamboos cut, but only with a view to open out the clumps, so that bamboos will remain standing all over the clumps at about 6 in. apart.
- (5) The contractor will prepare from the bamboos cut in the above manner marketable bamboos of all possible sizes, and will export them, after payment of a fixed rate of royalty, which is settled at the annual public auctions and noted below.
- (6) The contractor also pays a security deposit in cash, varying from Rs. 25 to Rs. 100, according to the size of the coupe in which he works, for the due fulfilment of the above conditions.

The above system has been found during the past three years to promise a practical and financial success. The contractors are bound down by formal agreement and security to thin and clean the bamboo clumps properly and to export all the marketable bamboos after paying a fixed royalty. Of course, we have special difficulties in one way. For instance, where the number of congested clumps is large, it is impossible to expect a contractor to clean all of them in one season, as

he must make some profit. In some such instances I was obliged to make a condition that out of one hundred clumps from which the contractor cuts bamboos there must be at least 25 congested clumps which he must clean. At this rate the total number of congested clumps in that particular block will have been cleaned out in 4 years. Again, for instance, I think condition (1) will not perhaps hold good after the clumps have been improved by the annual thinnings; I think we are getting much more new growth now, and that we shall perhaps have to cut about half the number of culms in good clumps to keep them from getting congested.

The famine in the past two years hindered the progress of our bamboo work, as of all others, but there is no doubt that the present system is a good one. We are doing material improvement in our bamboo forests, not only without any cost whatever, but with the profit of all the royalty we obtain from the cleanings and thinnings. In 1897-98 we cleaned out 15,442 congested clumps without cost, and the revenue obtained from the operation was still Rs. 1,104.

The rates of royalty paid by contractors for bamboos exported from the thinnings, as referred to in condition (5) above, are as follows:—

Kind of bamboos.	Rate per score.					Standard for the Division.
	Ranipur.	Bām.	Chillawali.	Sūkh.	Monand and Khujnawar.	
Sarauch 15 ft. long.	0 5 0	...	...	...	...	0 5 0
" 12 " "	0 3 0	0 1 6	0 2 3	0 2 3	0 2 3	0 2 0
Chaneju 10 " "	0 2 6	0 1 3	0 1 9	0 1 9	0 1 9	0 2 0
Bahi 7 " "	0 2 6	0 1 3	0 1 9	0 1 9	0 1 9	0 2 0
Charkalan 10 ft. "	0 2 6	0 1 3	0 1 9	0 1 9	0 1 9	0 2 0
Charkhurd 8 " "	0 1 3	0 0 6	0 0 9	0 0 9	0 0 9	0 1 0
Rakmi or Punchi (top pieces) 10 ft. long. }	0 1 3	0 0 6	0 0 9	0 0 9	0 0 9	0 1 0
Lathi 6 ft. long ...	0 1 3	0 0 6	0 0 9	0 0 9	0 0 9	0 1 0
Paini or Kain 4 ft long.	0 0 6	...	...	0 0 3	0 0 3	0 1 0
						per head load.

The above statement shows that we are getting royalty, which is very nearly equal to the standard rates of the Division. In fact we are actually getting more in Ranipur owing to its proximity to the Jwalapur bamboo market,

Extract (para. 100) from the Annual Administration Report of the Central Circle, N.-W. P. and Oudh, for the year 1895-96.

In the Ganges Division an experimental attempt was made at cleaning the bamboo clumps over a given area of forest, with the view of increasing the productive capacity of the clumps. When subjected to constant cutting the bamboo clumps get so choked with the dead stumps left from previous operations, that if the production and development of new stems is not hindered thereby, as would seem probable, the labour of getting at the latter is considerably increased. However, the experiment clearly showed that the expense and difficulty of control attaching to the operation are obstacles to its introduction into practical forestry. Moreover, the bamboos on an area thus cleaned might all flower and die within the next few months, thereby rendering useless all our labour and expense, and this possibility is of itself sufficient to condemn the practice of cleaning the clumps.

In the Conservator's opinion the most practical way of increasing the supply of bamboos will be to abolish the existing system under which each bamboo block is closed for one year before being cut over again.

The voluminous correspondence on the subject of bamboo production shows that even experts are unable to state positively that the annual cutting of the clumps is calculated to decrease production; in fact, common sense would seem to support an opposite conclusion, when it is considered that the order of plants to which the bamboo belongs is peculiar, for the property possessed by them of multiplying the number of their stems and the vigour of their growth in proportion to the cutting back to which they are subjected. We see instances of it in our grasses which flourish and extend laterally in proportion to the degree of surface cutting applied to them. To open the entire bamboo area to annual cuttings would, in the Conservator's opinion, *just double the outturn* from this source, and the subject is consequently one deserving the most serious attention. If the people do not require so large a quantity of bamboos, they will at least, under this change of system, get them cheaper.

II.—CORRESPONDENCE.

Method in Fire Conservancy.

Sir,

O. C's letter on the above subject in your February number shows I was not sufficiently definite concerning the Fire-gangs I advocate. *One* gang in a widely distributed area under protection might, no doubt, be of inconsiderable use, but

the way is to have several small gangs, so placed that one or other of them will always be within measurable distance of any fire that may break out. But the details of the arrangement will, of course, depend on local circumstances, such as the extent and distribution of the forest under fire-protection, the form of country (hilly or otherwise), the class of forest, its vulnerability, and so on. Perhaps, however, the idea will be best illustrated by quoting an actual example, though the arrangements adopted in this particular case may in the future, with increased experience, be improved upon.

The fire-protected forest was about 300 sq. miles, or something less, covering a long, rather narrow line of rough, dry hills, spreading into a broad end, the greatest length being 50 or 60 miles. The species were Bamboo, Sál and miscellaneous trees (like *Anogeissus*, *Lagerstrœmia*, *Terminalia*, &c.). The risks were in parts considerable, because of great inflammability, a neighbouring population passively hostile—or at least unsympathetic—many cross paths, and other dangers. For this area there were, besides fire-watchers, five gangs, aggregating some 50 men, working in five different ranges. One range could be conveniently dealt with from two neighbouring ranges, and besides being exposed to comparatively few risks had no works in it upon which men could be employed during the hot weather—and consequently this range had no gang. Similarly, another range was not exposed to much danger and so, also, had no gang.

The works upon which the gangs were employed consisted of extensive climber-cutting, girdling in coupes that had been worked through, tree-markings over numerous large areas, the removal of a great deal of refuse on fire-lines, girdling and felling on lines to be made the following year, the upkeep of certain roads open to heavy export (which would have been stopped otherwise), the removal of grass huts from risky places, the pegging out of future roads, the re-painting of iron roofs, the carriage of materials, and a variety of other works. The Working Plan in that Division requires so much to be done that, unless the work is carried on into the hot weather, the practicability of getting all the work finished in the year is doubtful—certainly proper supervision could not be given to it—and were it not for these organised gangs no labour at all would be obtainable at that time. Further, it happens occasionally that some unforeseen work will arise (as, for example, the unroofing of an Inspection house by a storm) that *must* be seen to somehow before the coming rains. Thus there was *ample* work of a suitable kind for the men, and when fires occurred their presence was invaluable.

One instance of this may be given. A fire broke out in a very dangerous place in a Sál forest, from which old fellings

had removed all the old stock, but in which the young crop only required rest to grow into an exceedingly valuable property. The grass is very high and inflammable, and if the fire had been allowed to get out of hand, very great damage would have resulted. This it certainly would have done had the only help consisted in the village population (which was distant, not numerous, and rather hostile) and exporters (who were mostly down-country cartmen, very poor hands at the work). But the local fire-gang of about a dozen men, together with a few forest guards and fire-watchers, arrived on the scene with such promptness, and worked with such vigour, that the fire was quickly extinguished, and confined to a quite insignificant area, in spite of the great difficulty of the place. It was the special duty of these men to do this work, and, however dimly, the sentiment of duty does act. Another thing is that special firemen realise that the sooner they reach, and the more vigorously they attack a fire, the less trouble will they have. This is a thing impressed men never seem to grasp sufficiently.

The above is only one of many instances of excellent work done by the fire-gangs.

When the range officer sends in the monthly muster roll of his gang he should make a note on the reverse separating out the different works upon which the men have been employed, and of course only the actual time spent on fire work should be charged to Fire Conservancy. When part of the pay is withheld till the close of the season, the voucher under which it is finally paid should have a reference on it to the original voucher, and so confusion will be avoided.

The works done in this way by daily labour during the hot weather will not be cheaply done, but the advantage is more, I think, than the disadvantage. If one fire, which would otherwise have reached 1,000 acres, is by the entertainment of a special fire-gang kept down to 100 acres, the State will, on the whole season's work, be really a pecuniary gainer.

I anticipate increased difficulty in Fire Conservancy in the future, until the time, still distant, when the forests shall have grown up thickly and killed out the grass; and, therefore, I think we need to systematise and strengthen our protection. We ought to be able, *as a rule*, and not only as an exception, to put a *speedy* stop to fires when they break out; it ought to be the exception for a fire to extend to, say, 100 acres. The case of the Hanikhet Reserve, which I quoted in the November number of "The Forester," where every year seven or eight fires break out but are never allowed to extend, should be only a sample of what took place everywhere.

Moreover, it is very unedifying for the village population (which is unfortunately only too often, at the least passively, hostile) to see large fires raging in the "band jungle." It constitutes a standing invitation to anyone spitefully inclined, and an

obvious object lesson of how easy—how very easy—it is to get a damaging blow home at the Forest Department. We *have* to show we lay great stress on fire-protection, and if, being as we are, “*ex officio*” unpopular (if I may use the expression), we are at the same time clearly unable to defend ourselves with tolerable certainty, the temptation to fire the forest will always be alluring. On the other hand, if our organisation is such that the probability is that an incendiary fire will be suppressed before it does much damage, malicious people will find it less profitable to light them. Disaffection increases with success in its efforts, and conversely, disappears when they fail.

Our Fire Conservancy returns give a percentage of failures which is *relatively* low, but *actually* many square miles are burnt annually. We can the less afford this now that so much ground is coming under improvement and other fellings, and the area under valuable and improving young stock constantly increasing. The Government of India Report for 1896-97 shows that the failures were only about 5 per cent., yet this amounted to *one thousand five hundred and thirty-three square miles*! The total cost of Fire Conservancy was only Rs. 3,03,688, out of a total expenditure of Rs. 1,00,45,150, while the cost per square mile was something under Rs. 10, that is, something less than 3 pies an acre. (Roads and Buildings cost 4½ lakhs). When we consider these figures, and also consider the absolute necessity of fire-protection, is it not apparent that we are fully justified in spending more than we do in rendering it safer and surer than at present? Why should we allow *9,81,120 acres* (1,533 square miles) to be burnt annually?

But I hope the day will come, when the Sâl forests at any rate, will be grown under some system of close growth, such as in Europe is applied to Beech, whereby, save in the areas under regeneration (say one-quarter, or at most one-third of the total), the stock will kill out all grass. Already here and there we meet with examples where self-protection is acting. Even among young crops I have seen fires rendered almost harmless, or even actually extinguished by the close growth. I think that one of the main points which a Working Plans Officer should consider, when deciding on his future Method of Treatment, is the extent to which it will lend itself to easy fire-protection.

The day of sufficiently close-grown forests is, as yet, no doubt distant, though steadily approaching, but when it comes our expenditure and difficulties in Fire Conservancy will be materially reduced. In the meantime there is *ample* room for a more, methodic and *sure* system of Fire Conservancy than at present obtains,—at least in those parts of India with which I am acquainted.

Sir,

The discussion going on in the columns of your Magazine regarding Fire Conservancy is very interesting and may, I hope, lead to good results.

I fail to see, however, why those who write on the subject should hide their identity. I presume the writers are Forest Officers, but all the same their statements would have more weight if authenticated; it is often difficult to fix an initial. For instance, Sir Dietrich Brandis hints that "H. H." (see the February number) may be a possible Lieutenant-Governor, while I mistook the initial for that of a Bengal officer: perhaps he may belong to the N.-W. P. However, be that as it may, it seems to me that "G. E. M." (see the January number) has been very unfortunate in his experience. To have dealt with fire-traces for 15 years and to have only once found them of use in checking the onward march of a fire, does not speak well of the fire-traces. I have known a fire stopped by a foot-and-a-half *pag-dandi*! I can't identify "G. E. M.," or I might have some idea of the country he is alluding to. However, the main point I would now refer to is the measures adopted, and apparently with success, by "G. E. M." *viz.*, fining heavily his subordinates, if they fail to trace the offenders. This course seems to me, if followed always, to permit of a good deal of injustice. The granting of promotion and rewards is also often open to objection as actually leading to the perpetration of offences, and should only be adopted, in my opinion, after most careful enquiry and circumspection.

I agree that it is essential that fire-traces should be systematically laid down, but at the same time I consider a Divisional Officer, especially if of some experience in the Division, is often more competent to deal with such matters than a Working-Plans Officer. Nevertheless, every Working Plan should, I think, carefully discuss and draw up fire-protection measures in conjunction with the Divisional Officer. I may have more to say on the subject when I have time to consider "O. C.'s" and Sir Dietrich Brandis' articles in your February issue.

A. E. WILD.

Sissu and Mulberry at Changa Manga.

Sir,

I was very pleased to see Mr. Rogers' letter on the above subject in the October number of the *Indian Forester* for 1898, but there are a few points on which I do not agree with him.

The idea that mulberry was *originally* introduced into the Changa Manga Reserve by the canal water is, I think, wrong. Mulberry was artificially sown and planted when the plantation was started, and the present crop of mulberry has resulted from this source, chiefly through the agency of the "Tillyers" assisted it is true by the canal water, natural regeneration in the ordinary way, jackals and other animals. I believe that the same result would have been obtained by the action of the "Tillyers," alone, even if no mulberry had been introduced artificially; but that by the canal water alone the dissemination of the mulberry would have been a very slow process. If the canal played such an active part in carrying the seed, as is supposed by Mr Rogers, then how is it that the cultivated fields are not sown up densely with mulberry seed, as they are irrigated with the same water; and, also, why is it that the areas originally sown with sissu seed in the plantation did not contain a large proportion of mulberry during the first rotation, the result of seed deposited at the time of irrigation. Had mulberry seed been deposited at this time by the canal water, then we should have obtained a crop of mulberry instead of sissu in the first rotation: for we know that if of equal age, the mulberry very soon overtakes and suppresses sissu.

In May 1896, an area of 200 acres of *rakh* land was added to the plantation and sown with sissu seed. This area has been watered by the canal for two seasons, and now contains an excellent crop of sissu plants of an average height of nine feet; but there are no mulberry plants with the exception of a few isolated ones, probably from seed dropped by birds flying overhead. If the canal played an active part in carrying about the seed, it must have introduced some to this area.

Mulberry grows just as well in the open as under the cover of trees,* and hence, if the canal is the important carrying agency, we should expect to find mulberry seedlings as plentiful in the open, as under trees; but this is not the case. Only a few isolated plants appear on areas devoid of tree growth, whereas they are plentiful under the cover of trees and are generally very dense under the standards on the regeneration areas. The reason for this is that the "Tillyers" are the most important agency at work in disseminating the seed: mulberry does not appear to any large extent on areas devoid of tree growth, because these areas are not visited by the birds, as they afford no suitable resting places. As soon as the sissu crop grows of sufficient size to form a congenial locality for the birds, it is visited by them and mulberry is introduced. This is seen as an advance growth although stunted for want of light in the compartments felled at the end of the first rotation. The standards on the regeneration areas are especially attractive resting places for the birds, and under these trees mulberry seedlings are always very plentiful. It is often noticed that the seedlings are only present

* Is not the mulberry delicate and shade-demanding? HON. ED.

on one side of a tree, being that side to which the tree is leaning, or on which the branches are developed, whereas on the other side without over-hanging branches there are no seedlings.

As remarked by Mr. Rogers, jackals do eat the mulberry fruit; but the part played by them in disseminating the seed is insignificant compared to that of the birds. Man probably plays a more important part in this respect than jackals, as large numbers of natives come to the plantation to eat the mulberry fruit; and in the famine year it is said that a large number of natives lived for several days on nothing but mulberries.

Although mulberry does not occur on the plains to any large extent, except what has appeared in recent years, yet there seems no reason to doubt that it is indigenous to the plains. It requires much moisture in the soil and so one would only expect to find it naturally in a few suitable localities, and these are probably such as would be most frequented by man and cattle.

Owing to this limitation in its possible distribution, and also to the fact that it is very readily eaten by cattle, it would be easy to understand that it would be one of the first species to disappear with the advance of man. Now that canal irrigation has been introduced, large areas of country offer congenial localities for the growth of mulberry, and the species is rapidly re-instating itself. The mulberry thrives in the heat of the plains, and puts on its most vigorous growth during the hot weather. It would be interesting to compare its rate of growth as we ascend from the plains to the hills. If this were done, I think we should find that its growth on the plains is more vigorous than on the hills, which would tend to show that the plains are its natural habitat. This, of course, only applies to the species found at Changa Manga (*Morus alba*.)

I do not agree with Mr. Rogers' remark that "the sissu sucker and stool-shoots can hold their own with the mulberry stool-shoots for 2 or 3 years." This is only true on areas badly irrigated. In well-irrigated compartments mulberry coppice is, on the average, one to two feet higher than sissu coppice after the first year's growth. The result of the struggle between the two species is thus practically decided after the first year; and if we are to protect sissu, the mulberry must be cut back after the first year's growth, and for several successive years. How often it will be necessary to repeat the operation of cutting back the mulberry, in order to save the sissu from suppression, we do not yet know; but this will be learnt from the experience of the next few years.

With regard to the outturn from a fully-stocked area of sissu and from one of mulberry we have not yet sufficient data to rely upon; but my opinion is that the outturn from an area of mulberry will be greater than from an equal area

of sissu, and that there are more stems of mulberry to the acre than of sissu. What we want to obtain, however, is neither a pure crop of sissu nor a pure crop of mulberry, but a two-storied crop, with sissu above and mulberry below. If we can obtain this, we shall get a much larger outturn, a fair quality of fuel, good timber from the standards and also several sylvi-cultural advantages.

Mulberry is valued less as a fuel than sissu, because it has a lower heat power for equal weights, and so, is not an economical fuel for burning in the furnaces of engines. In open grates it is dangerous to burn, as it splutters and throws out sparks very badly. Sissu fuel can be sold readily, but the traders always grumble when there is much mulberry in the stacks. Mulberry timber only realises 5 As. per cub. ft., whereas 8 as. per cub. ft. is obtained for sissu timber. Only a few years back there was no demand at all for mulberry timber; but the demand for it is now steadily increasing. It is used chiefly for making tennis racquets, badminton bats, hockey sticks, handles for tools, &c., being an elastic wood. Carpenters complain that they cannot make the surface smooth even after planing, and so do not appreciate the timber for furniture and such like purposes.

The small beetle mentioned by Mr. Rogers as attacking the dead wood, only attacks the sissu billets and not the mulberry. The beetle is a Bostrychid of the Ptinidæ family and is probably the *Sinoxylon* figured on page 123 of Vol. III of the "Indian Museum Notes," which it very closely resembles.

Steps are being taken to introduce sissu by sowing and planting: so that there will be ample material for the provision of seedling standards in the next rotation.

When the first felling was made in the compartments which have just been felled for the second time *viz.* compartments 1 to 12, no standards were reserved, nor was any sowing or planting done, hence the standards now reserved in the compartments are coppice shoots; and it is somewhat doubtful if they will last to yield good timber, especially as they contain a large proportion of sapwood. One thing which is noticeable about these standards, is that they are very much better shaped trees than those of the first rotation. This is the result of the admixture of mulberry in the crop and clearly shows that fine sissu timber trees with straight boles, devoid of side branches could be obtained by growing the two species together.

The rotation for the standards has not yet been fixed, but data are being collected. The oldest trees in the plantation are from 25 to 30 years in age, and these average about 4 ft. in girth.

The mulberry is a species which has been very much abused, simply because its utility has not been recognised. As a timber and fuel, it is decidedly inferior to sissu, but at the same

time its timber and fuel are not to be despised. Now that we begin to understand how to treat the mulberry, we shall recognise that it is a most valuable addition to the Changa Manga Reserve. If left to itself it is undoubtedly a most unwelcome intruder, as it very soon ousts the sissu, the more valuable species; but if properly controlled and kept below the sissu it should be a very valuable addition to the Reserve.

Sissu is not a suitable species to grow pure, as it thins out at an early age, producing low-branched trees yielding inferior timber, and it does not fully utilise all the ground.

By the addition of mulberry as an under-forest the whole ground is fully utilised and a much larger outturn obtained than from a pure forest of either species. In addition to this, it forms a complete canopy, checking the growth of weeds and adding a rich humus to the soil. Both mulberry and sissu suffer badly from damage by wind when pure. It is quite common to see large clumps of mulberry with their crowns all broken off by wind, and also to see clumps of sissu over-turned bodily. Both these dangers are diminished by growing the two species together.

In these two species we have the material for the production of a splendid high forest. We can never expect to obtain good timber from sissu grown pure, as, owing to its light-demanding nature, the trees in their struggle for light assume the most fantastic shapes, growing at all angles; and, if thinned to prevent this, they simply form side branches, which are almost as bad. This being the natural condition in which sissu trees are generally seen, it is commonly supposed that they cannot be grown straight. This is entirely an error. By growing sissu with an under-story of mulberry and by making thinnings when necessary, there is no doubt that we can produce sissu trees with straight clean boles, which would yield fine timber. This result could be brought about either by introducing mulberry after the sissu has grown sufficiently high to hold its own, but before the trees have assumed a bad shape of definite form, or by growing the two species of equal age and cutting back the mulberry until the sissu could hold its own. The different methods of treatment are just the same as would be followed in the case of oak and beech in Europe.

B. O. COVENTRY.

Wire rope-way at Mount Stuart.

SIR,

I have read with interest your correspondent's paper in the *Forester* of January last on the erection of a wire rope-way at

Mount Stuart. I think you will agree with me that it is to be regretted that "F. A. L." gives us no information whatever as to the actual working of this line of transport, which after all, is the main point. I believe I am right in assuming that most of us, who have had anything to do with these aerial lines, have found that it is not so much their erection that constitutes the difficulty, but their successful working subsequently. I trust, therefore, that your correspondent will favour us with some further details with regard to the working of this wire rope-way, and its probable financial result; also, that he will let us know in which part of the world the Mount Stuart he refers to is situated.

E. Mc. A. M.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Note on Improvement Fellings for the benefit of Teak in fire-protected Reserved Forests, Burma.

In 1870 a formal declaration of the forest policy for the future working of the forests in British Burma was made by the Chief Commissioner in his Resolution on the Forest Administration Report for 1869-70 (paragraph 20 of Public Works Department letter No. 426-48F., dated the 6th August 1870). The policy was laid down on two lines merely, the second of which was:—

"To look to plantations as the future main source of our timber requirements."

In their review of the above the Government of India (Public Works Department No. 620F., dated the 15th October 1870, paragraph 19) endorsed this policy and expressed its scope more definitely, as under—

"The general duties of the Department for the present may briefly be stated as follows:—

- (1) *The extension of teak plantations on a large scale in a few well selected blocks.*
- (2) *The demarcation of the most valuable forest tracts as State forests.*
- (3) *Meanwhile, careful husbanding of the resources of the existing forests."*

2. During the 28 years that have elapsed since then, vast changes have taken place both as to the extent and as to

the [constitution of the teak-producing areas entrusted to the management and control of the Forest Department in Burma.

When the above forest policy was defined, it seemed not improbable that the civil divisions of Pegu and Tenasserim would have to be considered the main sources, from which the world's future supply of teak timber would have to be drawn, and measures had to be considered for ensuring in the future the maintenance of a sustained yield of marketable teak timber.

Now, however, we have not only a well organized system of management, prescribed by working-plans, either already sanctioned or else shortly to be prepared for sanction, in force throughout the principal teak forests in Lower Burma, but we have also the control and a fairly good knowledge of the vast teak-producing tracts spreading over enormous areas in Upper Burma and the Shan States. The Government of Burma have now under their control huge areas, which certainly equal and probably far excel, the forests of Lower Burma in the quantity of first class marketable teak which they are capable of supplying, *in perpetuo*, under competent management.

3. With such sources of supply now at command it is no longer necessary "*to look to plantations as the future main source of our timber requirements.*" So much so is this the case that the time has now come for asking whether it may not be advisable to curtail teak plantation work, so far as is practicable, and to invest the money thus made available for the carrying out of improvement fellings for the benefit and development of the existing stock of immature teak, whether trees, poles, saplings or seedlings, usually to be found in greater or less abundance throughout all teak-producing areas.

4. Where teak is not now found as a constituent among the trees of any forest, or is only sparsely represented, it stands to reason that it can only be introduced artificially by means of sowing or planting. Apart from exceptional cases, such as relate to agreements or questions of policy with regard to Karen or Kachin tribes and the like, where the Forest Department is, or may be committed, to forming plantations in order to secure the good will of such hill tribes, or to carry out agreements made at the time of forest settlement of reserves, there has been throughout the last ten years a strong and an ever-strengthening opinion that plantation operations should be curtailed, and that more attention and money should be devoted to improvement fellings. In teak-producing areas it is seldom that *taungya* tracts can be selected so as to include no teak, and in some instances the damage done to the existing stock of teak and of cutch is sufficient to stamp the formation of plantations in such localities as unnecessary and wasteful. In proof of this, attention may be called to recent reserve inspection notes.

5. When teak plantations were originally started it was hoped that after about two years' weeding and cleaning they might be trusted to outgrow danger from lofty grasses, creepers, softwoods, &c. Experience has shown that such is not the case. It is only in very exceptional cases that plantations can be left unweeded in their third year, and sometimes the operation has to be repeated during the fourth year. Even then weeding and cleaning have to take place at intervals for several years more; and such weeding and cleaning operations are hardly or even not yet completed when one finds one's self face to face with the necessity for thinning. Thus, in 1896, I found myself compelled, as Conservator of the Pegu Circle, to have plans of thinning operations drawn up for plantations in the Tharrawaddy and Rangoon Divisions though funds were scarce.

The plantations in some of the divisions of Lower Burma are already so extensive as to seriously interfere with the other work of the Divisional Officers.

6. That areas suitable for improvement fellings abound in our reserves in Upper Burma can be proved by reference to the following portions of reserve inspection notes:—

Pyinmana Division Inspection Notes, 1896-97.

Natural regeneration of teak is on the whole very satisfactory considering the excessive extent to which the forests have been depleted of all mature marketable trees. But, owing to jungle fires, there is a striking paucity of *pyingado* seedlings notwithstanding the abundance of large and well-grown mature trees. Young teak trees and poles are frequent, and in many places seedlings are abundant, though at present burned back year after year by the jungle fires and overshadowed by the bamboo undergrowth (mostly *kyatphaung*). Under such circumstances, it seems to me that improvement fellings in selected and carefully fire-protected areas are the soundest, most advantageous, and most economical method of improving the future teak-producing capacity of the forests.

Notwithstanding the satisfactory nature of operations in those teak *taungya*, I am not in favour of extending them or of committing ourselves to the formation of plantations; for *natural regeneration* of teak is on the whole decidedly good throughout those parts of the reserve traversed, remarkably so, considering the treatment these forests have received during the last 30 years. Hence it seems to me better policy and more economical investment of money to make *improvement fellings* in selected areas to be carefully fire-protected for several years, i.e., which shall receive *special protection* in addition to any general fire-protective operations applied to the whole reserve or to large portions of it.

With the establishment now at our command, or with any increase likely to be obtained within the next year or two, we cannot afford to commit ourselves to plantations and at the same time hope to carry on improvement fellings successfully on any large and systematic scale: and of the two alternatives I think the improvement fellings deserve the preference considering the general satisfactory state of natural regeneration of teak.

In the revised plan of operations for 1896-97 proposals have been made for the formation of 100 acres of teak plantations. I am most decidedly of opinion that no further plantation work should be carried out here unless privilege-holders *claim* to clear *taungya* lands and plant them up with teak; and in this case they should only be allowed to clear *ya* in

such portions of the reserve as bear no stock of teak, as, for example, in some of the old bamboo *pénzo* near the northern end of the reserve. There are so many places in the Pyinmana block of reserves where *natural regeneration* of teak is very good, and where improvement fellings will yield far better and more remunerative results, that I consider the fire-protection and improvement of such selected areas a much preferable work to committing ourselves to *taungya* plantations with the toilsome years of weeding and cleaning, which are hardly completed before the necessity for thinning stares one in the face.

Cessation of planting.—I am most distinctly averse to the formation of any more plantations in this reserve. We have got rid of the privilege-holders who could claim to cut *taungya*, and *natural regeneration* of teak and of *pyingado* is already so good that nothing further is required than a continuation of the present successful *fire-protection* in order to permit seedlings to establish themselves. The Ranger states that, except in the *indaing* portions, it would be almost impossible to pick out blocks for planting which do not already contain at least 15 trees, poles are saplings per acre, not to mention seedlings; and his statement seems to be fairly borne out by the observations made during the present tour of inspection. In the 1896 plantations, 48 large logs of green teak have been extracted by the Bombay-Burma Trading Corporation, Limited, while numerous large teak trees and many poles have been killed or else damaged so badly as to be hopelessly disabled from ever developing into sound marketable trees.

Katha Division (Mohnyin Reserve) Inspection Notes, 1897.

Teak taungya plantations have not yet been begun, and there seems no necessity for making any commencement with them. Though *natural regeneration* of teak is at present extremely poor in the vicinity of Kadu, yet in the southern portion of the reserve drained by the feeder of the Ledan *chaung* it is particularly good throughout the areas in which *tinwas* forms the chief and characteristic undergrowth. Here *natural regeneration* in family groups is decidedly good, and though the experiment of annually cutting out the *wanu* or soft shoots from the bamboo clumps has not (as anticipated) resulted in any decrease of the amount of over-head shade, or in any diminution in the reproductive power of the bamboos, yet the clearance of all shoots in places where teak seedlings have been found has resulted in a very vigorous development of the latter. This method of treatment referred to in paragraph 50 of the working plan as *experimental operations for the reproduction of teak in the bamboo forest* should be carried on as extensively as the means at the Divisional Officer's disposal permit, for the formation of compact family groups of teak in this manner is probably the best of all means of regenerating this species. Moreover, the local climate and the characteristic vegetation of this reserve enable such operations to be conducted with a far freer hand than would be judicious in teak tracts in Lower Burma, where the *kyathaung* bamboo forms the main undergrowth. Cultural measures of this nature are easier to carry out, cost less, and entail fewer subsequent operations as to weeding and cleaning than teak *taungya*; hence it is better to expend on the former all the money and supervision at disposal than to sink these in plantations that will demand annually recurring attention as regards weeding, &c.

This, of course, by no means precludes full advantage being taken of exceptionally favourable opportunities for *natural regeneration* on a larger scale. Whenever bamboos flower sporadically or gregariously over reserved tracts, such tracts should be specially fire-traced, burned over whenever the bamboo seed falls, and sown or dibbled with teak. So far, however, as it lies in his power, the Divisional Officer should utilize the opportunities for *natural regeneration* offered by the removal of bamboos from patches showing a stock of teak seedlings and, if a well-considered plan can be forecast for thus treating portions of the reserve systematically year by year, this will be far more advantageous than operations of a less regular and defined nature. When all such areas have been operated on, it will be time enough to consider the planting up of the *pénzo* along the western boundary of the reserve

as prescribed in paragraph 50 of the working plan. In the meantime money and supervision can be more profitably invested in cultural operations of the above nature.

Katha Division Inspection Notes, 1898.

6. *Natural regeneration* is on the whole decidedly good. In the southern reserves (Pilé, Tatiwin, Pyindé, Nankan) and in Nami it is in many parts so satisfactory that this, assisted by fire-protection and by improvement fellings, should quite suffice for ample supplies of teak in the future. Near the Shimpa teak *tawngya* in the Nankan reserve, natural regeneration of teak is perhaps richer than in any other place I have ever seen. It is excellent, the various girth-classes being represented. Under such circumstances teak *tawngya* are quite uncalled for. Further remarks relating to this subject will be found below under 9—*Plantations*; but the following diary extract relative to the *Nami reserve* may here be quoted as illustrating the local conditions of the reserves:—

"In the evening went due east into the Nami reserve for about a mile-and-a-quarter. It closely resembles in character the reserves in the south of the division (Pilé, Pyindé, Nankan) in having apparently no marketable teak trees left standing, in having been fearfully hacked about by village girdlers, everything down to young trees and even poles having been killed, and in having a wonderful regenerative power. In many parts the ground is covered with seedlings, or rather with coppice-shoots, beside which the blackened, burnt shoot of 1896 stands or lies. As in the other reserves, no plantations are required here; fire-protection and improvement fellings are all that are essential, and would at the same time form a far more remunerative investment than plantations. The Nami *chawng* is a first-class floating stream."

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8. *Climber-cutting, ficus-cutting, and improvement fellings*, are—solely owing to want of trained supervision—unfortunately at present confined to the Pilé and Mohnyin reserves. As sowing and planting operations are really unnecessary in view of the fine natural regeneration of teak obtaining in many of the reserves, operations of the nature of improvement fellings seem the most remunerative and promising means of obtaining the best and most valuable future supplies of teak. The cheapest and most practical way of furthering this object is at present under the Conservator's consideration, and explicit instructions on the subject will issue before next working season. At present the creeper-cutting and the felling of stems covered with epiphytic *ficus* is carried out by the ranger or forester a year in advance of the improvement felling, the latter being undertaken by the Extra Assistant Conservator of Forests in Pilé reserve and by the Divisional Officer, Mohnyin. Under such circumstances the rate of progress is obviously far behind what is desirable, as only comparatively small areas can be dealt with annually.

Ruby Mines Division Inspection Notes, 1898.

Natural regeneration is on the whole fairly good. In some parts, particularly throughout the northern portion of the block of reserves, the regeneration by means of family groups of teak is excellent, all age classes being duly represented. All that is wanted for the development of the teak in such localities is fire-protection and improvement fellings.

Such conditions are not merely characteristic of the Eastern Circle of Upper Burma teak forests alone. They likewise obtain with regard to the majority of the teak-producing tracts which form the reserved forests throughout the Pegu and Tenasserim Circles (Lower Burma), and I am informed that similar conditions are also found throughout the chief teak-producing (reserved) areas in the Western Circle (Upper Burma).

7. It will be seen from the above extracts that *such improvement fellings are only intended to be carried out in fire-protected areas*. This is a *sine qua non*, and the whole of the suggestions contained in this note are based on the understanding that such improvement operations shall, of course, take place only in areas protected against fire.

8. Unless artificially assisted in its struggle for existence with the various other kinds of forest trees, &c, many of which are of more rapid growth than teak, it must naturally follow that a larger outturn in teak and a higher financial return from the reserved forests can only be expected in proportion to the expenditure incurred, under competent supervision, in assisting the teak in its struggle for existence, in shortening the duration of such struggle, and in obtaining for teak special advantages for growth and development by the felling or girdling of trees which strangle it (*Ficus*), or dominate, or otherwise interfere with its crown of foliage and its free exposure to light and air. For such *improvement fellings* money and trained supervision are essential. Moreover, this is not an operation which can be done once for good and all. It will have to be repeated from time to time, at intervals which should not exceed ten years, if this can be rendered possible with the means at our command.

9. The total area of reserved forests in Burma now amounts to some 15,000 square miles, and before the selection of State reserves is completed, it will probably amount to over 20,000 square miles. Of this it may be estimated that not less than the half, or 10,000 square miles, will be teak-producing tracts which should be gone over by *improvement fellings* at intervals not exceeding ten years. This will give an area of 1,000 square miles per annum to be operated over, or 640,000 acres annually. Even, however, presuming that this estimate may perhaps be far in excess of the area that really deserves and requires to be operated over, or that can be fire-protected and rendered suitable for improvement fellings, then let it be drastically reduced by 50 per cent, and there still remain 500 square miles, or 320,000 acres to be gone over annually, if we are to accord to the teak forests the treatment essential towards providing anything like the outturn in timber and money which the State may derive under proper management of their very valuable forest properties.

10. But we have at present no staff of provincial officers or of trained subordinates such as is necessary to operate properly over even a tithe of so extensive an annual area as 320,000 acres. Past experience in different parts of Burma has shown that operations like *improvement fellings*, which require circumspection and a certain amount of judgment, cannot be entrusted to untrained rangers. Such operations have, in some cases, proved not merely a waste of money, but have

actually been productive of positive harm, in place of bringing benefit to the existing stock of young teak.

11. Such untrained rangers can only be trusted to fell all trees (whether teak or not) in the bonds of epiphytic *Ficus*, and to cut woody climbers; and these are preliminary operations which should take place during the working season before that during which improvement fellings take place. When this preliminary step has once been taken, there still remains for consideration how, and to what extent, trees interfering with the growth of teak should be removed. Leaving bamboos and other lofty grasses out of consideration, the trees that it may be desirable to deal with for the benefit of the teak trees, poles or seedlings, may belong to one or other of the following three classes:—

- I.—*True heart-wood trees*, which die on being girdled.
- II.—*Sap-wood trees*, whose vegetative processes do not appear to be interfered with by girdling.
- III.—*False heart-wood trees*, which sicken or are distinctly interfered with, temporarily, in growth by girdling, but are not killed by the operation.

This last or intermediate class consists of kinds of trees which might perhaps in many instances be killed off by a second girdling, if it were practicable to go over the area again and re-girdle in the following year.

The I class (*true heart-wood trees*) comprise the more valuable kinds of timber trees like teak itself, catch (*Acacia catechu*), padauk (*Pterocarpus indicus*), pyingado (*Xylia dolabriformis*), ingyin (*Pentacme Siamensis*) and also such trees as the following:—

Taukkyan (<i>Terminalia species</i>).	Petthan (<i>Heterophragma adenophylla</i>).
Thitpyu (<i>Xanthophyllum species</i>).	Naywè (<i>Flacourtia species</i>).
Thadi (<i>Bursera serrata</i>).	Thitpagan (<i>Millettia species</i>).
Thitya (<i>Shorea obtusa</i>).	Seikche (<i>Bridelia retusa</i>).
Thitsi (<i>Melanorrhæa usitata</i>).	Petwôn (<i>Berrya amonillis</i>).
Thabye (<i>Eugenia species</i>).	Binga (<i>Nauclea rotundifolia</i>).
Ngu (<i>Cassia fistula</i>).	Thande' (<i>Stereospermum nauranthum</i>).
Tè (<i>Diospyros Burmanica</i>).	Sit (<i>Albizzia procera</i>).
Kokko (<i>Albizzia Lebbek</i>).	
Yamane (<i>Gmelina arborea</i>).	Mahlwa (<i>Spathodea stipulata</i>).

The II Class (*sap-wood trees*) includes the following among many others:—

Thabutgyi (<i>Miliusa velutina</i>).	Baing (<i>Tetrameles species</i>).
In (<i>Dipterocarpus tuberculatus</i>).	Thitè (<i>Oastamopsis species</i>).
Kanyin, (<i>Dipterocarpus species</i>).	Myauklòk (<i>Artocarpus Lakoocha</i>).
Thipwe (<i>Elæocarpus bracteatus</i>).	Myauknyo (<i>Duabanga sonneratioides</i>).
Yôn (<i>Anogeissus acuminata</i>).	Kathit (<i>Erythrina species</i>).
Thitsein (<i>Terminalia Belerica</i>).	
Zibyu (<i>Ococa Macrocarpa</i>).	

Letpan, Diddôk, Kokbê, (*Bombax species*).
 Myaukchaw (*Homalium tomentosum*).
 Thapan (*Ficus glomerata*).
 Gwe (*Spondias mangifera*)
 Gvo (*Schleichera trijuga*).
 Nabe (*Odina Wodier*).
 Chinyôk (*Garuqa pinnata*)
 Ma-n (*Sarcocephalus species*).
 Nagyê (*Pterospermum semisagittatum*).

Thayet (*Mangifera indica*).
 Thitni (*Amoora Rohituka*).
 Thanthat (*Albizia lucida*).
 Pauk (*Butea frondosa*).
 Bambwê (*Careya arborea*)
 Ondôn (*Tetranthera laurifolia*).
 Zinbyun (*Dillenia pen'agyna*)
 Zaungbalwe (*Genus unknown*).
 Shaw (*Sterculia species*).
 Myanhôkshit (*Siphonodon celastrinus*).

The III Class (*false heart-wood trees*) contains such trees as—

Thitlinda (*Heterophragma sulfurea*)
 Bôn-mêza (*Albizia stipulata*).
 Thitpôk (*Tetrameles nudiflora*).
 Lêza (*Lagerstrœmia tomentosa*).
 Yingat (*Gardenia species*).
 Bebya (*Cratoxylon neriifolium*).
 Hnaw (*Naucllea cordifolia*).
 Ondôn (*Tetranthera laurifolia*).
 Kyunbo (*Premna tomentosa*)
 Yindaik (*Dalbergia cultrata*).

Madama (*Dalbergia species*).
 Taunksha or Kyetyo (*Vitex leucocorylon*).
 Thitmagyi (*Albizia odoratissima*).
 Kuthan (*Ilymenodictyon thrysi-florum*).
 Lettôkgyi, Lettôkthein (*Holarhena species*).
 Pyinma or Tikhmwe (*Lagerstrœmia flos reginae*).

Panga (*Terminalia tomentella*).

The above classification must not be taken as hard and fast, for it is based only on the local observations made during one working season in the Pyinmana and Katha Divisions. A comparison of further and more comprehensive observations is therefore requisite, more especially with regard to many of the trees arranged above in the II and III classes. This enumeration of trees either unaffected or else only partially affected by girdling, however, extends to some fifty trees commonly to be found associated with teak in teak-producing areas. Experimental improvement fellings carried out in the Yanaungmyin reserve (Pyinmana Division) during June 1897 showed as their result that not only 42 per cent of the trees girdled survived the operation, although the girdle was deep and broad, but also that in November, five months later, in many cases no material reduction was noticeable in the density of their foliage, and in that of the shadow cast by them on the underwood. This fact is one which demands very careful consideration, as it really forms the *cruz* of the whole matter at issue.

12. As regards the trees of the I class, which die when girdled, the girdling operations can be performed by coolies working under the supervision of any subordinate. But what cannot be safely entrusted to untrained rangers is the selection of trees to be removed. In such cases it has only too often

happened that large trees have been girdled for the sake of very small seedlings. Hence the result has often been to benefit other species of trees or bamboos far more than the young teak. Besides this, inspection has shown that untrained rangers seem to lose all sense of proportion between the cost of girdling a large tree on the one hand, and the prospective benefit to be gained in affording special protection to a very small seedling or a badly-grown pole. To train special men as *gaungs* (on about Rs. 40 to Rs. 50 per mensem) for such improvement girdlings should, however, be a simple matter. It should not be more difficult than to train enumerators for valuation surveys in connection with the formation of working plans.

13. With regard to trees of the II and III classes, it appears very questionable whether it would be safe to entrust such operations to any but trained rangers or Extra Assistant Conservators of Forests. The experiment might perhaps be tried to employ specially trained *gaungs* on such work. In fact, it can only be by adopting some such plan that any real effort can possibly be made to cope with the enormous annual areas, which must be gone over, if the Forest Department is to be expected to adequately improve (in teak-producing capacity) the areas entrusted to their care on behalf of the State.

But such *gaungs* can, under no circumstances, be allowed to undertake operations except under the direct supervision of a competent trained ranger or an Extra Assistant Conservator of Forests or Assistant Conservator of Forests. An experiment is now being made in each of the divisions of this circle to see if sap-wood trees and false heart-wood trees can be killed by means of corrosive sublimate inserted into them for the purpose of poisoning their sap. If it should prove successful, then this mode of gradually killing them may, perhaps, be found capable of application on a large scale. But in any case trained supervision will be necessary to direct and control the killing of the trees so as to ensure that their removal will not be in reality more beneficial to useless trees, bamboos, &c., than to the teak it is intended to benefit.

14. Recent experiments in the Katha and Pyinmana Divisions show that an Extra Assistant Conservator of Forests or trained ranger can direct and control the work of about 15 to 20 coolies, and can operate over about 300 to 350 acres per mensem. They have also shown that the cost of such operations, exclusive of the salary and travelling allowance of such officer, amounts on the average to about Rs. 1-8-0 per acre for the cutting of woody climbers, the felling of trees attacked by epiphytic *Ficus*, the girdling of heart-wood trees, and the felling of sap-wood trees overshadowing or interfering with the growth and development of teak.

15. Now, it is obvious that at the above rate we cannot hope to accomplish anything like the task of carrying out

improvement fellings over the whole of the teak-producing areas once every ten years. There seems no way of avoiding or obviating the conclusion that the rate of progress under trained rangers or Extra Assistant Conservators of Forests is much too slow to satisfy our requirements. To accomplish the task lying before us—a work of immense economic and financial importance as regards the stock of marketable teak timber a hundred years hence—it seems essential that we should give special training to a number of selected men to act as *gaungs* or overseers (on Rs. 40 to Rs. 50 per mensem), and that each *improvement-felling party* should consist of an Extra Assistant Conservator of Forests or a trained ranger controlling and supervising the work of five such *gaungs*, each working with 15 coolies a day. Such a party would proceed to the area to be operated over, where the Extra Assistant Conservator of Forests or trained ranger in charge would occupy a central camp, the *gaungs* or overseers being distributed round about in their own camps within a mile or two of the central camp. From the latter the Extra Assistant Conservator of Forests or ranger in charge could conveniently supervise the work of each of the various sub-parties at least once a week. As soon as the operations in one portion of the forest were completed the whole party could move on to another portion and continue operations there.

Even with such control and supervision there would always be a risk of the Burman *gaung* or overseer acting injudiciously with regard to the felling of sap-wood trees and those having a false heart-wood (classes II and III, as above). But, with the supervision of a competent officer, exercised at least once a week, this risk seems preferable to having the work of improvement fellings done practically only in dribblets, leaving vast areas un-operated over. A definite plan based on fire-protection operations extending to a fixed area, and carried out in a prescribed sequence, is essential to the proper execution of such work.

10. The average cost of each such improvement-felling party would be as follows:—

I.—*Each sub-party—*

	Rs.
One <i>gaung</i> or overseer at Rs. 45 per mensem	45
Fifteen coolies at 10 annas per diem, say	255
Total per mensem	300

II.—*Full party—*

Consisting of five such sub-parties, per mensem	1,500
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Each sub-party ought to be able to accomplish the whole of the work of creeper-cutting, *Ficus* felling, and girdling or felling inferior species interfering with teak over at least 200 acres per mensem, or 1,000 acres per mensem for the full party, at a cost of Rs. 1,500, or Rs. 1-8 0 per acre. The better parties might accomplish work over 300 acres per mensem, but it seems

preferable to adopt the lower number as the minimum unit of area which should be operated over by a sub-party. Each party should be able to work for three months; hence the total area operated over should, therefore, not be less than 3,000 acres per annum, costing Rs. 4,500. Most likely this total area might be increased as the men acquired skill at the work, the total cost remaining the same, but the rate per acre becoming diminished; consequently it may perhaps be safe to put the three months' or season's work of one such party at 5 square miles (3,200 acres). It would, therefore, require 100 such parties and an outlay of Rs. 4,50,000 per annum to accomplish the full amount of work necessary in the future interests of the teak forests throughout Burma, as referred to in paragraph 8 above.

17. With the very limited number of trained rangers, Extra Assistant Conservators of Forests, and Assistant Conservators of Forests at disposal, it will of course not be practicable (quite out of the question, in fact) to dream of conducting operations for very many years to come on anything like so complete or extensive a scale. But I think the subject is, at any rate, of such importance that it should be referred (in the absence of any professional Head of the Department in Burma) to the Inspector-General of Forests, now in this province, to advise the Local Government—

- (1) as to the extent to which such improvement fellings should be made in each of the four circles;
- (2) as to the extent to which operations should be conducted with regard to sap-wood trees and false heart-wood trees which do not die after being girdled;
- (3) as to the sequence in which the operations should be carried out;
- (4) as to the agency to be employed, *i.e.*, whether the Extra Assistant Conservator of Forests or ranger is to operate directly with coolies or to supervise the operations of sub-parties in charge of *gaungs* or overseers; and
- (5) as to the time of the year during which the operations should be carried out.

He will thus have an opportunity of contributing towards the solution of one of the most difficult, and one of the most important problems, which the Forest Department in Burma has now to consider. Mr. Ribbentrop's remarks in paragraph 3 of his letter No. 25 W.P., dated the 24th January 1898 (copy of which was forwarded under cover of your Forest Department letter No. 75-1W.—4, dated the 4th February 1898, and an extract of which is hereto appended for ready reference), are most unquestionably correct; but they neither recognize nor provide for the necessity of having, first of all, a full, free and critical discussion of the various points requiring consideration; and secondly, having well-considered proposals prepared and

placed before the local Government for definite orders as to the line of action to be taken in carrying out this important work throughout the whole of Burma. No reserve is homogeneous in character as to growing stock and physical factors. In no division are all the reserves similar in character. And in no circle are the circumstances of the different divisions and reserves anything like similar. But the main principles ought obviously to be laid down for general application as to the manner in which the work should be taken in hand; and Mr. Ribbentrop's visit to Burma seems a very favourable opportunity for obtaining a definite opinion from the Head of the Forest Department on the subject which may be acted on consistently throughout the four circles in the immediate future.

18. There is also another very important matter which should at the same time be considered, and consideration can hardly be suitably given to it unless in connection with a scheme for improvement fellings. I refer to the flowering, seeding, and dying off of the *Kyathaung* bamboo, which may now happen in any year, and must occur soon, over enormous tracts of teak forest on both sides of the Pegu Yoma. This will be a sylvicultural opportunity such as has never previously occurred in Burma. Simultaneously with the use of fire (under due control) as a destructive agent for killing the germinative power of the bamboo seed, improvement fellings, sowings, dibblings, &c., will have to take place, on the largest possible scale, capable of being adequately controlled and carried out.

As it is well known that the *Kyathaung* areas will require such special treatment at some early date, it may perhaps be preferable not to include them at present in the instructions which may be issued by the local Government with regard to improvement fellings in other teak-producing areas. But in any case, I would recommend that the Inspector-General of Forests, in the absence of other professional Head of the Forest Department in Burma, be invited to formulate a definite plan of action for the treatment of the *Kyathaung* tracts before the general flowering takes place shortly. Unless such definite plan of operations be discussed and decided on beforehand, the flowering will find the Forest Department without any well-considered line of action ready for adoption. It is impossible that, with the means now at disposal, anything like a quarter of the area can be subjected to the cultural measures and improvement operations that will be desirable for future financial reasons.

19. Special consideration will have to be given to the time of the year at which improvement-felling operations should be carried out. I consider that the best time is to commence operations immediately after the first showers of rain have fallen, and the main danger from fire is past. This would mean conducting them from the second half of April till the second half of July. With good bamboo *tás* or huts for all engaged in the

work, this season of the year is less trying and less unhealthy than work which would extend into the hot season. Coolies object to hard work at the hottest time of the year, but they do not mind working in the rains so long as their hair is protected from getting wet. At such time of the year the intelligent class of working-plans enumerators would probably be willing to continue in service as *gaungs* or overseers in charge of sub-parties. If the work be carried out during the months of December to February, then this also means that the Extra Assistant Conservator of Forests or ranger cannot carry out other important duties, which can only be done at such season; and it also vastly increases the danger from fire owing to the extra mass of highly inflammable matter thus caused to litter the ground. As improvement fellings will only be carried out in fire-protected portions of reserves, this is a matter of considerable importance. Moreover, in most localities, the requisite supply of labour is much more difficult to obtain in December to February than from the end of April to July.

J. NISBET,

Offg. Con. of Forests, Eastern Circle.

Extract of letter from the Inspector-General of Forests to the Revenue Secretary to the Government of Burma,—No. 25 W. P., dated the 24th January 1898.

3. With regard to paragraph 51, I think that more definite prescriptions should be laid down in the (Yeni) working plan regarding the proper execution of the improvement fellings. These are of the greatest importance as regards the future constitution of the forests, particularly as fire-protection favours the growth and reproduction of softwoods to a greater extent even than it favours teak; and the execution of such an important operation should not, I think, be left too much to the discretion of the Divisional Officer.

Obituary Notice.

Wm. Protheroe Thomas, Deputy Conservator of Forests.

It is with regret that we have to announce the death of W. Protheroe Thomas, lately Officiating Conservator, Berar.

W. Protheroe Thomas joined the service in 1869, and was appointed to the Central Provinces as an Assistant Conservator. In these Provinces he was destined to serve, almost without interruption, for a period of nearly 30 years.

Under these circumstances, any attempt to record the services of Thomas would necessarily entail giving a history of the Forest Department in the Central Provinces from its first beginning. For, in 1869, when Thomas first joined, the Department had only just set to work. In those days only a small number of large compact tracts of country, and generally only those containing the more valuable species, had been selected and handed over to the Forest Department: but the vast area of Government waste-lands remained with the Revenue authorities. Almost without exception, areas selected as Government Reserves were situated in the more remote parts of the Province, far removed from the better known, populated and cultivated areas, and, consequently, though a Forest Officer enjoyed greater freedom, he had, on the other hand, to undergo many privations unknown to the vast majority of the officers of the present day. It was shortly after his appointment to the Central Provinces that Thomas was deputed to the far away Alapilli Teak forests to carry out sleeper operations; the Department having contracted to supply a large number of sleepers, within a limited period of time, for use on the Bengal-Nagpore line, then under construction. These operations were undertaken on the spur of the moment, no adequate arrangements for the comfort or welfare of the officers engaged were attempted; and work had to be pushed through at all seasons, and continued throughout the rains. Into this work Thomas entered with enthusiasm and made light of privations and serious attacks of sickness; but there can be no doubt that all officers suffered seriously in health, and Thomas never completely recovered.

On the completion of the work in the Alapilli Reserves, Thomas was transferred to the Northern districts; and it is chiefly in those districts, in Jabalpur, in Saugor, and particularly in Hoshangabad, where he served for the last 12 years of his service, that Thomas made his mark; and it is there that he will be long remembered by his numerous friends, both Europeans and Natives.

It was shortly after his transfer to the Nerbudda valley, and as a result of a visit of inspection made to the Provinces by Dr. Schlich, then Inspector-General, that all Government waste-lands were handed over to the Forest Department. These waste-lands covered vast areas, and the natural result of this enormous accession of land-wealth to the Department was that its *modus operandi* had to be radically altered. The Department now came in contact with the people and into possession of forest lands, which had to be worked, primarily, for the benefit of the adjoining villagers, whose wishes had to be considered and respected. Forest conservation and protection could, therefore, only gradually be introduced, and then only successfully with the aid of the people. These facts Thomas was among

the first to recognise, and during these years of transition, when indispensable forest restrictions were gradually being introduced, Thomas' management of his Forest Divisions met with the greatest success. His knowledge of the people and of their requirements; the firm, but sympathetic manner in which he gave effect to policy of the last few years did much to educate the agriculturalists, and the aboriginals to the necessity of forest conservancy. And, it is largely due to his administration of these divisions that it was found possible, a few years back, to introduce, at short notice, a radical change in the working of the forests; the old license system being, suddenly and with the greatest success, replaced by a scientific and professional method of working. As a successful fire-protectionist, Thomas early made a name for himself; and the success of his fire-conservancy in Hoshangabad, both in the fire-protected reserves, and in the open forests were remarkable, a result which must be largely attributed to his personality. There are many officers now working in different parts of India and Burmah who had the good fortune to serve their first apprenticeship under Thomas. Strict scientific forestry was perhaps not possible in the Central Provinces in those days; but as regards the manner of carrying out any forest works, the management of subordinates, and in hospitality they found in Thomas both a sound teacher and a genial host. These officers and his many friends deeply regret his loss. Appointed to officiate as Conservator in Berar in December 1897, his health completely broke down, and he died on his way home on board the P. and O. Steamer "Caledonia," off Plymouth, on the 18th of March last, aged 49.

IV.—REVIEWS, &C.

Surveying Instruments. *

By Thiéry.

Monsieur Thiéry, Professor at the National Forest School, Nancy, has recently published a book on surveying instruments, which can be very strongly recommended both to the student and those engaged in the practical work of surveying. It has been thoughtfully written and carefully arranged.

Each detail in the construction of the different instruments and the methods of use are elaborately and systematically explained.

* Des Instruments topographiques, description, réglage et méthodes d'observation. Par E. Thiéry, Nancy, Imprimerie Nancéenne, 1899.

The chapters relating to Levels and Theodolites; and their use in the measurement of heights, distances, and angles are particularly clear; and the illustrations, showing details of construction are practically well drawn and explanatory. The same commendation applies to all the diagrams.

The chapter on the Tracheometer is very good, and fully explains how this useful instrument is constructed and worked.

To give any idea of each instrument embraced in this work would mean a very lengthy article. It is sufficient to say that in it all the instruments in ordinary use, their errors, adjustments, and methods of manipulation, are most lucidly explained and illustrated.

State Forest Administration in South Australia.

The Report on State Forest Administration in South Australia during 1897-98, up to June 30th of the latter year, shows that, with little or no assistance, Mr. Gill, the Conservator of Forests, has managed to keep things going in a creditable manner over portions of that immense colony very far from each other. The main work reported is the up-keep of forest-tree and vine nurseries for the free distribution of the plants to the colonists, but there has been a vigorous and successful attempt to introduce date palms of superior kinds, and the report gives illustrations of the plantations showing the irrigation channels fed from artesian springs. The disastrous effect of the very dry season on the quite recently planted sugar gums is noteworthy, since that species of *Eucalyptus* was especially chosen for planting in South Australia on account of its withstanding the effects of a short and uncertain rainfall.

It is to be regretted that no mention is made of the regeneration of the natural *Eucalyptus* forests, in which a former Conservator carried on operations to improve the younger stems and encourage germination; and we look in vain for the later history of the original plantations of *Pinus Insignis* at Bundaleer, which are not touched upon. Perhaps Mr. Gill in his next report will deal with those points, which are of general interest outside the colony.

Annual Progress Report of the Forest Survey Branch of the Forest Department, Oct. 1897 to Sep. 1898.

Mr. Reynolds' Report contains an introductory map, showing at a glance the progress of forest surveys throughout India.

The Government forests are all entered and differently coloured according as they were surveyed previously, or during the year under review or remain still to be surveyed. Since its organization in 1872 the Forest Survey Branch has surveyed an area of 22,641 square miles. The branch extended its operations during the year to Burma, the Central Provinces, Oudh and the Punjab. It sent out no less than ten separate detachments on independent field work, each under European or qualified native supervision, and the outturn of work is best measured by the cost rate per square mile of the surveys, which is recorded as follows.

	Central Provinces.	Punjab (Chamba)	Burma.
Maps on the four-inch scale ...	Rs. 41-8	Rs. 50-5	Rs. 90-7
Maps on the one-inch scale ...	...	„ 19-9	...

The good work done by the Forest Survey Branch has been recognized from the beginning, and there can be but one opinion as to the moderate price that is being paid for the maps, which, in addition to the topographical detail and levelled contours recorded on them, are supplemented with tracings indicating the forest growth and classifying the soils.

Much forest survey work remains to be done, more particularly in Burma, Bengal and Assam, and we view with some concern the step which is contemplated and described by a contemporary as follows.

“So far as Forest Survey work is concerned in the Bengal Presidency, the Survey Department proper will in future join forces with the Survey Officers of the Forest Department, the amalgamation being known as the “Forest Survey of the Bengal Presidency.” The Inspector-General of Forests will determine the sphere of work and scrutinise the annual budgets, while the establishment in its actual working will be under the general and professional control of the Surveyor-General of India. The Party will absorb, as far as may be considered advisable, any or all detachments of the present Forest Survey Branch working in Burma, and the officer in charge will be placed in charge of all Forest Surveys in Burma and be under the administrative charge of the Superintendent of Forest Surveys, Bengal Presidency. The party will be stationed at Dehra during the off season.”

We understand that, instead of an officer of the Survey of India Department being appointed to succeed Mr. Reynolds (on his retirement) as Superintendent of the Forest Survey Branch, and to carry on the work on the same cheap lines, utilizing to the fullest extent not only native labour but also competent native supervision, the Forest Survey Branch is to be absorbed by the Survey of India, and amalgamated with those of its Parties now surveying forests, so as to form a Forest Survey Division for the

Bengal presidency. We very much fear that this arrangement will have the effect of levelling up the work of the old Forest Survey Branch to that of the Survey of India under its more numerous Europeans and more costly organization. We do not require any more highly finished maps than those of the Forest Survey Branch, even if under the new scheme such were to be produced; and from the moment the maps turned out become more costly and natives are excluded from a supervision for which they have apparently proved themselves adequate, there will be grounds for deprecating the change.

V.-SHIKAR, TRAVEL, &C.

Some experiences with Panthers.--

The want of Shikar stories in our magazine is so often brought up as a slur on our department, that I venture to send a short account of some experiences with panthers which seem to be somewhat out of the common.

That Panthers climb trees with the greatest facility is of course well known, but it may not be every one's luck to come upon them "up a tree," more especially as the extended view which they naturally enjoy in such a position, renders it, unless under exceptional circumstances, more difficult than ever to approach anywhere near them.

On the 15th April, one year, when I was posted in a Division somewhat near the centre of the Deccan, it happened that I awoke to find that it had been pouring with rain all night. The forests in which I was encamped at the time were teak forests, and everyone knows how useless it is to go for a stalk in such in the hot weather. Such a boon, therefore, as a heavy fall of rain, so uncommon at such a time, decided me to make the best of the opportunity and indulge in a stalk after bison, which, to my mind, is one of the most exciting kinds of Indian sport. I accordingly started at early dawn with a trusty Gond tracker. Before we had gone a mile, we heard the curious cry of what seemed to be a wounded animal. I thought it was a tiger and my thoughts flew at once to a tiger I had wounded two days before about three miles away—but that is another story.

My tracker, Tipo, said he was sure it was a big boar, so we approached in its direction, as silently as we could, hearing no more cries but instead we clearly heard the curious "koh-koh" of some wild dogs. As we got nearer we caught glimpses of wild dogs' heads as they jumped in the grass, which was about 4 feet high, but we could see no animal.

After a short time, however, we saw, crouched along a fairly erect branch of a *Saj* (*Terminalia tomentosa*) a panther, who was

so intent on watching the dogs below that he never saw us. Wishing above all things to pay off some long-standing grudges against wild dogs, which not only were causing fearful havoc among the game, but which were in the habit of taking a heavy toll from the buffalo calves whenever tied out for tiger, I tried to get a shot at them but could not, as we only saw their heads when they jumped in the grass around the trunk of the tree. I was then mean enough to take the poor panther at a disadvantage, and a shot behind the shoulder brought him plump to the ground. Nothing more was seen of the dogs which disappeared in the grass. I shall never forget the curious sight of the panther falling for those 50 feet through the air. We measured the distance we were from the tree and found it was 37 yards.

The panther was a male, 6ft. 1in. in length. The dogs must, I should think, have been very hard pressed to have attacked the panther, but that they had done so was evident and he had been driven to take refuge in the tree. In this he could only have been just in time, as his right fore-arm was found to have a great fresh gash in it, where a dog's tooth must have scratched him when, beginning to climb the tree.

A brother forest officer informs me that he has come across a case of wild dogs not only attacking a panther but killing it. He was encamped near a village in an adjoining district to the one in which the incident just related occurred. The village was in a neighbourhood which was troubled with a man-eating panther which often made its headquarters in some low hills near the village. L—went out for a morning stalk, and being attracted to a certain spot in the forest by a frightful hullabaloo, spotted some wild dogs, of which he bagged two and found they had just killed a panther and were eating him. I saw the old tattered skin, which was one of L—'s great treasures. The panther turned out, too, to be the man-eater, at any rate from that date on, the surrounding country was bothered by him no more.

Another curious case of a panther found "up a tree" occurred in one of the Easternmost districts of the N.-W. P. The forest was a dense growth of *Sál* poles. A certain plot was taken in hand for coppicing and the coolies discovered in a very acutely forked *Sál* tree the skeleton of a panther, some 15 feet from the ground. The only explanation possible seemed to be that the beast had climbed up there during a heat held by some people from the headquarter's station some time previous, and had got wedged in, and the more it struggled the tighter it became fixed.

The most unfortunate experience I have ever had, however, occurred with a panther this last winter. It is one thing to shoot large game in the plains when, even if one is on the ground, one has a firm footing, but it is quite another to shoot the same animals on the steep rocky hills of the Himalayas where, if one is a plains-man one can often hardly

stand firmly at all. I was then in a valley among the mountains behind the first ridge of snow. I had been out in the forest all day on the 7th February 1899, and was having tea on my return at about 4, my boots having been discarded for slippers. One of my servants came running in to say that he had seen two shepherds driving a panther down the hill-side, some half mile down the river. I snatched up my Express and ran down the narrow foot-path, more sheep track than anything else, along the northern bank, thinking it was very possible that I should have a view of the brute, if he was really being chased towards the river.

As I reached a certain *khud*, I saw an old shepherd on the opposite side who told me the panther was coming. I had just time to climb up the steep slope a few yards above the path when the panther came galloping along with a sheep dog at his heels. As he passed below I gave him the first barrel and knocked him off the path, giving him the second as he disappeared round a rock forming the end of a precipice, covered with *Euphorbia* and scrub growth, overhanging the river, which was some 60 or 70 feet below. I certainly ought to have killed the beast outright at such close quarters, and could not have failed to do so had I had a firm footing; while as it was, what with the steep slope and what with my slippers, I had the greatest difficulty in standing up. At the first shot the dog turned round and disappeared from the scene being as startled as the panther was. We then moved above the precipice and tried to dislodge the panther; after heaving rocks for 5 minutes or more, we overbalanced a huge rock on the edge and I caught a glimpse of the panther's coat and fired vertically down at it, causing him to drop almost into the river, as he only just saved himself in some scrub above high flood level.

In this scrub he crouched out of sight once more. A shepherd, some 50 yards lower down the river said he thought he could see him and so I went round to where he was, but I could see no panther. However, the man declared he was beneath a certain shrub and as all the rocks the men continued to heave from above failed to move him and it was beginning to get dusk, I sent a bullet into the shrub hoping to move him, but it had no effect.

Meanwhile the shepherd had climbed a tree behind me and below me. The tree was a *siris* (*Albizzia Lebbeck*) growing just above flood level, very branching and with an almost horizontal trunk. The upper branches were in my sight, and I had no idea either that the man was climbing up it, or that the trunk was such as it was. After my shot into the bush I was directing the men above the precipice to throw down more rocks, when out the panther bounded towards me but still some 20 feet or so below. Apparently the panther had seen the man climb the tree and was making for him in my right rear. I gave him another shot and he disappeared between the rocky

bank I was on and the river. I had just re-loaded my ejector when I saw the panther climb into my line of sight on the *siris* tree, and above him there was the shepherd. I blew the beast out of the tree and he fell out of my sight 40 feet clear on to the rocks below, and immediately, to my disgust, the poor shepherd lost his head and fell after him from sheer fright. He fell alongside of the panther on to solid rocks, breaking his arm and some ribs. The panther, in his dying effort, took the man's hand in his mouth and bit it but hadn't strength enough to break any bones. I got down below at once and polished off the beast. The poor fellow, however, although he was attended to at once by the Hospital Assistant on the forest works who was there, died 36 hours later. He complained of pain in his chest and difficulty of breathing, and, doubtless, his fall on the rocks had caused the fractured ribs to pierce his lungs. It was a sad business and I hope it may never be my fate to witness such another accident. The bad luck of the whole thing seemed to be that five out of the six bullets hit the panther (not counting, of course, the one fired into the bush) and three of these were in his head, one in the neck, the last being in the shoulder. It seems incredible that four .500 Express bullets could be placed in a panther's head and neck and not touch a vital spot. It is so very noticeable in big game shooting, that a bullet in a given spot may be fatal, if it is the first, on account of the shock caused in addition to absolute physical injury, and yet, if a bullet be put in the same place as a second or third shot, it seems to often have no effect, the real reason being that no bullet but the first causes, I think, such a shock to the animal. Be that as it may, it is an undoubted fact that a wounded animal takes much more killing, I am sure, than an unwounded one. The panther was the biggest I have yet bagged, being 7 ft. 8½ in. in length and with an extremely fine coat.

F. Z. S.

VI.—EXTRACTS, NOTES AND QUERIES.

India at the Paris Exhibition.

A note has been drawn up by the Department of Agriculture and Revenue, setting forth the position of affairs in regard to the representation of India at the forthcoming Paris Exhibition. It states:—

It was not until February last that detailed plans showing the space available for India reached the authorities here, and as exhibits will not be received in Paris after the 25th February, 1900, it is evident that the time for preparation is all too short. The space placed at the disposal of India consists of an ornamental double-storied building in the Trocadero Gardens facing the

Seine close to the Pont d'Jena. A total space of some 20,000 square feet has been allotted for exhibits from British India and Ceylon. The Indian section has been divided into three courts. (1) The imperial, in which the exhibits of the Government of India and of native States will be shown; (2) The private exhibitors, in which the more artistic productions of Indian manufactures, merchants and others will be displayed; and (3) The commercial, in which the trade and economic samples will be exhibited.

The Indian Government has decided to confine its own collections to forests and minerals, but the forests' collections will include specimens of wood-carving and panelling with the view of exemplifying the utility of Indian woods for decorative purposes. Sir Edward Buck, K. C. S. I., one of the members of the Royal Commission, Indian Committee, has lately been in India on tour, and the Indian authorities have had the advantage of consulting with him as to the best method of adapting the forest and mineral exhibits to decorating the imperial court. The chief feature in this court is to be a central stand or "trophy" of carved wood-work 36 feet long by 12 feet broad by 26 feet high, which is being prepared from designs made by, and under the personal superintendence of, Mr. B. Ribbentrop, Inspector-General of Forests to the Government of India. The trophy has been designed so as to show, in the most attractive manner possible, specimens of the best wood-carving on different ornamental woods that India can produce, and at the same time to provide a suitable show case for works of art and value which may be exhibited by native States. On either of its longer sides the trophy will have a handsome archway 13½ feet high, flanked by ornamental pillars and carved panel work. One of these sides has been allotted to Burmese carvers, whilst the other will be executed by Punjab artists. The carving work of one of the ends will be carried out by the Mysore State and the other by Baroda. Other native States will be suitably represented both in the ornamental work of the trophy and in the exhibition cases. The show cases will be supported by marble pedestals and the floor-way under the main arches will be of ornamental parquetry made from handsome Indian woods; whilst polished panelling of padauk, ebony, &c., will finish off what should prove a beautiful and unique example of Indian workmanship and art. Some of the recesses around the main central trophy will be occupied by smaller trophies, representing the wood-carving of Madras, Rajputana (except Jeypore, which already finds a place in the main trophy) Central India and the Punjab States. These are intended for the exhibition of contributions from native States. During his visit to India Sir Edward Buck ascertained from some of the leading native States of India that they were willing to contribute carved wood-work for the trophy, and also to send other exhibits of

characteristic arts. It is not known at present to what extent such contributions will be forthcoming, but from the above description it will be clear that a suitable habitation for valuable and curious specimens of art is being prepared. A good amount of space has also been set apart in the side arcades of the imperial court for the exhibits of native States. The question of locating an Indian tea and coffee-room in the central court is also under consideration. In former exhibitions such tea-rooms, managed by the Indian Tea Association, have been very attractive, and also very effective in furthering the objects of the association.

Pioneer, April 26th.

Prodigious growth of Douglas Spruce.

We extract from Mr. Henry S. Graves' article on the Douglas Spruce of Northern Oregon, in the March number of the "Forester" the following interesting table of yield and remarks relating to nine sample plots.

Summary of Sample Plots, Showing Yield per Acre at Different Ages.

Plot.	Area.	Number of trees.	Number of trees under 1 inch.	Average diameter, breast high.	Maximum diameter, breast high.	Average age.	Average height.	Contents.	Density of the forest.	Number of trees per acre.	Contents per acre.	Cords per acre.	Locality.
No.	Acres.			Ins.	Ins.	Yrs.	Feet.	Cu. ft.			Cu. ft.		
1	0.06	242	109	1.8	7	23	29.0	.....	1.0	4,038	.....	..	Osoekamas. Ore.
2	0.25	701	126	2.9	10	22	38.0	1,087	1.0	2,604	4,346	..	Shelburne. "
3	0.25	168	....	6.7	16	32	60.0	1,618	1.0	672	6,451	72	Clackamas. "
4	0.25	128	....	7.1	20	41	74.0	1,118	0.8	428	4,451	51	Shelburne. "
5	1.0	646	....	7.3	17	38	81.0	8,901	1.0	645	8,901	99	Shelburne. "
6	1.0	490	....	8.0	19	37	78.0	8,036	0.85	490	8,036	90	Shelburne. "
7	1.0	360	....	10.2	21	40	86.5	7,812	0.9	360	7,812	87	Shelburne. "
8	1.0	353	....	8.0	19	60	91.1	6,742	0.8	353	6,742	76	Clackamas. "
9	1.0	150	....	19.9	40	63	139.0	17,280	0.7	150	17,280	190	L. Perwella. "

"These figures show that on a fully stocked plot there are between 3,000 and 4,000 trees per acre at twenty years of age. As the trees grow older they require greater room for their development, and in consequence many are overtopped and die. While the number of trees per acre falls off with increase of age, there are still 150 trees on Plot No. 9 at the age of eighty-three years with a density of only seven-tenths (a fully stocked area being rated as one). The most striking feature of the table is the large yield in cubic feet and cords. An examination of the last column of figures will show that the mean annual increment is something over two cords per acre."

The cord is apparently equivalent to 90 cubic feet and the mean annual increment seems to have exceeded 200 cubic feet per acre in woods 83 years old and not even fully stocked, the trees numbering 150 to the acre and averaging close on 5 feet in girth at breast height and 139 feet in height. We should be disposed to look on an acre bearing such a crop, as sufficiently densely stocked; and probably be considering whether a light thinning would not be conducive to the better development of the stems.

Cactus hedges and Fire-protection.

A fairly unforeseen use has recently been made of the Cactus in the south of France. This use consists in surrounding the young plantations of pine with hedges of *Opuntia*. This plant resists fire by reason of the great quantity of water stored in its tissues, and it was thought of as a possible means of protecting the plantations from the frequent fires to which they are exposed. One might go a step farther and, wherever the *Opuntia* can live, so increase the number of such hedges in all wooded tracts as to fence in forest fires and prevent their easy and disastrous spread.

M. Roland Gosselin has stated before the Societe d' Acclimatation that, having been present at a fire from which the *Opuntia* escaped unharmed, he was able to satisfy himself that the plants of this genus withstand admirably a hot grilling. A week after their exposure to the fire new shoots and flower buds were beginning to appear.

Herein seems to lie a system of fire-protection, which might be of great service in the Esterel and also in the Landes, provided always a kind of *Opuntia*, easy of acclimation in that latter region, can be found.

Translated from L'illustration, 11 Mars 1899.

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

April 5th, 1899.

EAST INDIA TEAK.—The deliveries for the first three months of this year amount to 5,482 loads, against 6,145 loads in the same period of 1898; the figures for March alone being 1,769 loads against 888 loads in March last year. The demand for the few available floating cargoes continues, and high prices are being paid for fresh supplies.

ROSEWOOD.—EAST INDIA.—The market keeps firm as there is a good demand which is not being over-supplied.

SATINWOOD.—EAST INDIA.—Finely-figured logs sell well but the demand is not large and there is a fair stock on hand.

EBONY.—EAST INDIA—Sizeable wood, sound and of good colour, would command fair prices, provided shipments were small.

PRICE CURRENT.

Indian Teak	per load	...	£11 15s.	to £16 15s.
Rosewood	" ton	...	£9	to £11
Satinwood	" ft. (supr.)	...	5d.	to 12d.
Ebony	" ton	...	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 5TH APRIL, 1899.

TRAK.—The landings in London Docks during March consisted of 1,933 loads of logs and 326 loads of planks, aggregating 2,259 loads, against 1,515 loads of logs and 395 loads of planks and small scantling delivered from the Docks into consumption.

The landings during the first quarter of the year total 3,551 loads, as against a total delivery into consumption of 5,681 loads, and the dock stocks on 31st March analyse as follows :—

7,410	loads of logs,	as against	12,417	loads at the same date last year.
3,477	" planks	"	3,383	" "
28	" blocks	"	14	" "
<hr/> 10,913 loads		"	<hr/> 15,814 loads.	

The above consumption for the three months falls some 5½ per cent. below that for the corresponding period of last year, but the striking fact remains that it is, nevertheless, 60 per cent. in excess of the imports, as shown by the above figures. The present landed stocks however, may be considered quite sufficient to supply all likely wants during the next quarter of the year, during which time a fair share of the present modest floating supplies will doubtless find its way to this market. In the meantime, all holders of landed stocks and floating supplies are well placed, although it would be unwise to over-estimate the strength of a position which is based upon a continuance of the increased rate of consumption during the last few years, which expansion is largely, although not entirely, owing to the demand from all quarters for warships, and this demand may be appreciably diminished by the increasing disposition on the part of Foreign Governments to minimize the use of inflammable material in such ships, and also by the checking of unduly swelling armaments by some understanding between England and the other great Naval Powers, as recently adumbrated by the First Lord of the Admiralty.

In order to develop the healthily growing disposition to use Teak for general purposes other than ship and rolling-stock construction, artificial values are to be depreciated, and it is for the merchant and dealer, as well as the consumer, to do all possible to discourage the ever-growing disposition of both the Burmese and Bangkok foresters to force up prices. The present level is still reasonable, but if further raised it will inevitably tend to decrease the consumption for domestic and general purposes.

Business has been of a sound character during the first quarter of the year, and the demand has been consistently steady, if not quite attaining to that briskness which marks business as being in full swing. Whether the recent flood-tide of general good trade is nearing the ebb remains to be proved, but prices continue firm in all directions, and consumers who cover their requirements at present rates for the rest of the year seem certain to lose nothing and may anticipate the undue booming of markets, which such sound business prospects as those of the last four years may well develop.

MARKET RATES OF PRODUCE.

*Tropical Agriculturist.**April 1st, 1899.*

Cardamoms	per lb.	2s. 9d.	to	3s.
Croton Seeds	„ cwt.	55s.	to	70s.
Cutch	„ „	9s. 3d.	to	9s. 6d.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	65s.	to	75s.
India rubber, Assam	„ lb.	2s. 9d.	to	3s. 3d.
„ Burma	„ „	2s. 9d.	to	3s.
Myrabolams, Madras	„ cwt.	6s.	to	6s. 6d.
„ Bombay	„ „	4s. 3d.	to	9s.
„ Jubbulpur	„ „	4s. 9d.	to	9s. 6d.
„ Bengal	„ „	4s. 6d.	to	7s.
Nux Vomica	„ „	8s.	to	10s.
Oil, Lemon grass	„ lb.	3d.	to	3½d.
Sandalwood, Logs	„ ton	£30	to	£50.
„ Chips	„ „	£4	to	£8.
Sapanwood	„ „	£4	to	£5.
Seed lac	„ cwt.	55s.	to	62s. 6d.
Tamarind, Calcutta	„ „	12s. 6d.	to	14s. 6d.
„ Madras	„ „	4s.	to	6s.

CORRIGENDA.

Indian Forester, April 1899.

Page 162, line 3 from below *for* 1868 *read* 1869.

168, line 10 from above *for* Inspector-General *read*
Assistant Inspector-General.

Indian Forester, May 1899.

Page 214, line 7 from below	}	<i>for</i> Protheroe <i>read</i> Prothero.
" " " 5 " "		
" " " 4 " "		



HEAVY TEAK LOGS CARTED BY ELEPHANTS
BURMA

THE INDIAN FORESTER.

Vol. XXV.]

June, 1899.

[No. 6.

A log-lifting Machine in use in Burma with carts drawn by elephants.

The machine for lifting heavy timber on to carts, of which a picture is herewith given, may be of some practical interest. It is used in the Thingadon forests of the Lower Ohindwin district in Upper Burma, where logs have to be dragged or carted for many miles over loose sand. This machine, being very simple and very light, can easily be carried about from place to place, wherever required, and so has an advantage over the more cumbersome contrivance depicted in Mr. Fisher's "Forest Utilization"

It consists simply of an iron screw, about 2 inches in diameter, and about 4 feet long, with a square thread, working in an iron nut, which rests on the centre of a light wooden gallows about 6½ ft. high. At the lower end of the screw is a swivel ring through which a chain can be slung, and just above the ring four iron handles project, like the spokes of a capstan, for turning the screw.

Logs which are too heavy to be rolled on to the carts in the ordinary way, are slung by a chain somewhere near the middle, and then raised by men turning the screw.

The "gin daik"—a low cart with broad solid wheels—is placed near the end of the log resting on the ground; a man now gets on to the other end of it, which is in the air, and by his weight raises the end near the cart, which is then pushed along under the lifted log, to the required position. This machine belongs to the Bombay-Burma Trading Corporation, Limited.

H. J.

The large Elm of Kulu.

In October 1876 the large Elm with drooping branches, which in Kulu is known under the name of Marn, attracted my attention. At that time I only found leaves, but a few years afterwards one of my friends sent me specimens in flower and young fruit. In May 1881 I found the same tree in the Pabar valley at an elevation of 4,000 ft., and on the ticket written by me at

the time, the vernacular name is stated as Marn. At the Herbarium here there are, besides the specimens collected by myself and by my friend, leaves and a piece of the bark gathered by the late Dr. Aitchison on the Jhelum river between 5,000 and 7,000 ft. The ticket says. "A good sized tree, bark used as rope." There is also a specimen in leaf collected by Dr. Henderson on the Yarkand expedition in 1870, and there are specimens (leaves and young fruit) collected by Dr. T. Thomson in Kashmir in 1848, at 5,000 and 5,500 ft., marked "large tree."

In his "Flora of British India," Vol. V. p. 480, Sir Joseph Hooker has united this tree with the Himalayan Elm, *Ulmus Wallichiana*. This species, however, I knew well in 1876, and had no doubt in my mind that the Marn of Kulu was different. My ticket on specimens of *Ulmus Wallichiana* gathered in Kulu in October 1876 says. "Imbri Marāl, a large tree, lopped every other year." On a specimen collected by me in May 1863 in the Amlawa valley of Jaunsar, the vernacular name is given as "Narag." I also gathered it in Bussahir at 6,500 ft. in May 1881, under the name "Imbri," and in Kunawar near Tranda at 7,000 ft. under the name "Maldang."

Ulmus Wallichiana has the young shoots and leaves always pubescent, while those of Marn are perfectly glabrous. In *Ulmus Wallichiana* the venation between the numerous parallel secondary veins is very minute, very regular and prominent on the underside, unless obscured by the pubescence. In Marn the secondary veins are also parallel and numerous (15—18 pairs), the tertiary veins are prominent, particularly on the underside, and their branches form an entirely different venation with much larger meshes, than is the case in *Ulmus Wallichiana*. The chief difference, however, consists in the fruit, which in *Ulmus Wallichiana* is glabrous, or only slightly pubescent and conspicuously reticulated, while Marn has a villous or silky fruit, with a dense fringe of long white hair on the sharp edges.

It will be a matter of considerable interest to study the Elms of the North-West Himalaya, and to ascertain, whether the "Marn" of Kulu must be regarded as a distinct species. Bark, timber, mode of growth, time of flowering, the appearance of seedlings and other characters should be studied. Both species are in flower early in the season, before the leaves appear, and in both the indehiscent flat fruit is on a long slender peduncle which is articulate near the base.

Should the Marn prove to be a distinct species in the judgment of those Foresters who have the good fortune to be working in the North-Western Himalayas, I am disposed to call it *Ulmus villosa*

D. BRANDIS.

Kew, April 1899.

Wood-pulp.

The utilization of the waste products of our Indian forests is a most important problem, but in many cases, even where the uses such material can be put to are known, there are serious difficulties to be overcome. In the case of wood-pulp, however, it is indeed to be wondered at that no enterprising capitalists come forward to develop the industry in this country.

In Europe the manufacture of wood-pulp has been going on steadily for many years, but so great is the demand for timber there, the manufacturers are able to obtain only a comparatively small supply of the raw material required. The consequence is that, although new uses of wood-pulp are discovered every day, the industry has not expanded very considerably.

It is in America, both in the United States and Canada, that wood-pulp is creating a veritable revolution in the mercantile and manufacturing world. So much so is this the case that "*The Times*" says:—

"The extraordinary development of the single manufacture of 'wood-pulp, which only a few years ago was practically unknown and is now used not only for making paper but for clothing and an immense diversity of other articles, is a sufficient indication of the practically limitless extension of the already widely 'varied uses of timber.' "Cotton," it is said on the other side of the Atlantic "was once called king; but king Cotton is a 'lesser potentate than king Timber must soon become.'"

All the American papers are full of accounts of the wonderful development of the industry in that country, and of the constantly increasing uses to which wood-pulp is now put. It is in fact this industry that has brought home at last to the people of America the urgency of making State reserves, protecting them from fire and managing them systematically; for, as long as lumber only was exported from the forests the younger and smaller trees were left, but now that the wood-pulp man has appeared no trees escape, as he utilizes all the trees left by the lumber man.

The New York Tribune, referring to the numberless uses of wood-pulp and the inroads caused on the United States' Forests says:

"Printing paper alone eats an enormous hole in our national 'forests yearly, and the future extent of that requirement can 'only be conjectured. The huge procession of railway cars all 'over the country run, to some extent, on paper wheels; carpenters are beginning to use boards of paper, handsomely veined, 'requiring no planing, twice as durable as the wooden variety, 'and costing only half the money. The builder is introducing 'paper bricks, showily enamelled, which will not burn, and possess 'many advantages over those of burnt clay. The ship-builder

'introduces masts and spars of the same substance, which is likewise used for telegraph and telephone poles and flagstuffs. These are not fanciful experiments but serious business procedures, justified by the superior durability of the articles so produced. The same quality is claimed for the paper horse-shoe recently invented and now extensively used. An enumeration of the purposes for which this surprising protoplasm has come to be employed would stretch into a catalogue and new ones seem to be discovered every day.'

Verily we are approaching the day referred to in the chorus of the old song.

'Paper hats, paper coats, paper boots and shoes,
'Patent paper sailing ships and patent paper crews.
'On the paper market there'll be a paper strain,
'And every one, both young and old, will have paper on the brain.'

The chief wood used for pulp is spruce but silver fir is used in the Vosges mountains. Poplars, which have a short fibre, are also used but more especially for mixing with spruce pulps to give the paper a more even surface. Of spruce there is an unlimited supply in the N.-W. Himalayas, from the Bhagirati to Afghanistan, also in Sikkim and Bhutan. It grows chiefly on Northern and Western slopes between 7,000 and 11,000 feet. The species is of course *Abies Smithiana*, very closely allied to the common European spruce, *A. excelsa*. It attains a maximum height of some 225 feet, and a girth up to 16 feet. The wood is white like that of *A. excelsa* and weighs about the same, viz, 32 lbs per cubic ft on the average.

In the Jaunsar Division alone there is a huge stock of magnificent trees, which is unsaleable at present as there is no demand for it. So much so is this the case that wherever it happens to be found growing near deodar, it is ruthlessly killed by girdling and allowed to rot, so as to favour the valuable deodar. I roughly estimate that from this Division, were the spruce put under systematic management, an annual outturn of 150,00,000 cubic feet, or about 5,70,000 maunds, equal to about 21,000 tons by weight, could be obtained. If a large quantity like this were exported it is probable that it would pay the Forest Department to sell the wood at Dagpathar on the Jumna for about eleven annas a maund.

Wood ground mechanically yields, I believe, one-third of its weight in pulp (dry) and this the paper mills would, it is supposed, willingly purchase for at least Rs. 3 per maund delivered on the railway, as their agents in the bazars are now scouring the country for old pieces of paper of all kinds which have to be sorted, washed and bleached before being of any use. For this the agents give Rs. 2 per maund and they must get a good commission for all their trouble.

Fifty-seven thousand maunds of spruce would yield some 1,90,000 maunds per annum, or 633 maunds per diem (taking 300 working days = one year) of mechanically-ground pulp and this should sell for Rs. 5,70,000.

There is not likely to be any difficulty in disposing of this quantity as the demand for paper in this country is steadily on the increase, more or less in proportion to the spread of education and trade. Moreover, if good raw material were readily obtainable by the paper mills they would not be so keen on making arrangements, throughout India, to collect all the waste paper, however inferior its quality may be.

The probable annual receipts and expenditure for such an outturn would be as follows —

Receipts.		Expenditure.	
	Rs.		Rs.
By sale of 1,90,000 maunds of pulp, delivered at Dehra Dun Railway Station @ Rs. 3 per maund ...	5,70,000	Purchase of 5,70,000 mds of spruce @ 11 Annas per maund ...	3,91,875
		Wear and tear of machinery and buildings @ 10 % on Rs. 1,50,000	15,000
		Manager's pay @ Rs. 800 per month ...	9,600
		Mechanical Engineer's @ Rs. 450 per month .	5,400
		3 Foremen @ Rs. 50 each per month ...	1,800
		3 Do. @ Rs. 30 each per month ...	1,080
		60 Workmen @ Rs. 6 each per month ...	4,320
		Carting 1,90,000 maunds of pulp to Railway at 3 Annas per maund per 26 miles ...	35,625
		Miscellaneous charges ...	5,300
		Profit on capital of Rs. 5,00,000, @ s. 20 % per annum ..	1,00,000
Rs. ...	5,70,000	Rs. ...	5,70,000

The Capital required would be as follows :—

Cost of machinery	...	Rs. 80,000	} Rs. 1,50,000
Setting up, leading water and erection of buildings	...	Rs. 70,000	
Working Capital	...	...	Rs. 3,50,000
Total			Rs. 5,00,000

This is the prospect which seems to await any capitalist enterprising enough to take up the business ; and, if mechanically-ground pulp is able to give such a profit, what would the profit be on chemically-prepared wood fibre for paper and cloth? For, although it is somewhat more expensive to manufacture, the yield is as much as 60 to 66 per cent. of the weight of the wood against 33 per cent. of mechanically-ground pulp. Doubtless Government would be prepared to meet any capitalist willing to start the business, with an agreement to give him the first refusal of all spruce exported, *vid* Dagpathar, at a certain rate for a certain numbers of years, as well as to lend him a plot of land for his factory with a right to lead water from the river to propel the machinery, so that he could make his own calculations as to whether it would pay him or not. Government at the same time would benefit by the opening out of a market for spruce, for which there is now no demand.

There should be no difficulty in getting water power sufficient to drive all the machinery required for the factory as, I believe, the fall of the Tons river at the foot of the hills is about 45 feet per mile. Should a market for spruce be in this way developed, it would most probably pay the Forest Department to grow spruce on a rotation of 30 or 40 years.

The Canadian pulp factories have bought up large areas of forest land which I am informed they are treating on a 20-year rotation, but then the growth of American spruces, especially the Douglas spruce, is very rapid; *vide* the tables published in "*The Indian Forester*" for May 1899.

The trees in the plantation of spruce near Deoban in the Jaunsar Division made in 1874, when the plants were put out at one year old, now average 20 feet in height and 4.6 inches in diameter ; but the plantation is not densely stocked and the locality is one with an Eastern aspect, while spruce does not apparently grow thereabouts naturally. So it is expected that with a rotation of 30 or 40 years, in places suited to the species, it would give a suitable sized tree for pulp purposes. When once a regular young forest was formed, the age at which the mean annual increment per acre culminated would be determined, and that age fixed for future rotations. It is very possible that, if experiments were made at the factory, it would be found that silver fir could also be utilized, in which case it would be advantageous to grow a mixed forest of spruce and silver fir.

It is, indeed, to be hoped that a market will soon be developed for spruce, as it is too heart-rending a sight to see all the grand trees now growing being absolutely wasted; and, as mentioned before, being girdled and allowed to rot wherever they interfere with deodar, even though the latter be seedlings, a few years old.

P. H. CLUTTERBUCK.

Jaunsar, May 1899.

Forest ground-rent.

By CH. BROILLIARD.

Translated from the Revue des Eaux et Forêts, 15th April 1899.

In the *Revue des Eaux et Forêts* for the 10th June 1895, 10th February and 10th November 1896, M. A. Arnould took up the study of forest taxation and of the revenue survey on which it should be based. A reference to these articles will recall to mind the general principle governing this important question. It is there shown that the calculation of the assessable forest revenue must be based on the possibility, and worked out by the method of annuities. But since the interest here is compound, the difficulties of the calculation may be confusing to private owners, many of whom are not at home with such terms as annuities, compound interest, &c. We have been asked to give a summary of the matter and will now attempt to do so.

In the production of the forest revenue there are two distinct elements, or factors as they are often called now-a-days, namely, the soil and the wood. It is not very hard to discriminate the share of each. On a soil completely cleared by exploitation, the forest is reconstituted either by means of natural seedlings, by planting, or by coppice shoots. In the latter case, the reproduction being immediate, the forest re-growth is well known. What is its value? Though nothing appreciable at first, it is still the first term of the production to be realised in the future. It is therefore necessary to give a wood time to develop. It rarely requires less than 20 years for the sum of the annual growth to become a wood fit to cut; sometimes it requires a century or more before a wood becomes exploitable.

Thus, the exploitable wood, like the compound interest on a money capital, consists of the sum of annual increments, each added to those preceding, which in themselves besides acquire an increased value. All have contributed to the common work in the same manner at successive dates, drawing from the soil one year's flush of leaves. Thus it can be said, quite properly, that "this wood has put on its fourth flush"; "this coppice is in its 18th or 25th year's flush."

Each annual growth, each flush of leaves may be considered as an annuity* contributing to the total yield, not only by its own original amount, but also by means of its compound interest. The exploitation is deferred, for say 25 years, because at the end of that time the yield will include each of the annual growths, plus the interest due on each. But how can it be brought to account? By using the calculation for those annuities which allow 25 annual contributions to mount up to the outturn of the felling at the end of the term, at the rate of interest usual for forest investments in the locality.

For example, an annuity of 10 francs is paid at the end of each year for 25 years into a bank which allows 3 per cent. interest.

The bank book will show the following entries:—

For the 1st year 10 francs

" " 2nd " $10 + 10 \times 1.03$

being the second payment, plus the first payment with interest.

For the 3rd year $= 10 + 10 \times 1.03 + 10 \times 1.03 \times 1.03$

being the third payment, plus the second with interest, plus the first with two years' compound interest.

For the 4th and following years similarly :

Finally for the 25th year, the 25 annuities of 10 francs, plus the interest of the 24 earlier ones, each with its compound interest according to its date of payment; the total may be worked out or taken from tables, and amounts to 364 francs and 70 centimes.

In a forest this total is known, for it is the yield of the *coupe* the sale value of the standing wood. In a case similar to the above example, i. e., for the same age and rate per cent. the annuity is what would be calculated by proportion. †

* Annuity = annual payment.

† In any case the calculation by Algebra is simple. Let a be the annuity, r the rate, and n the number of years. The sum of the annuities and of their compound interests may be written.

$$a + a(1+r) + a(1+r)^2 + \dots + a(1+r)^{n-1}$$

Now, if V stands for the value of the *coupe*.

$$V = [1 + (1+r) + (1+r)^2 + \dots + (1+r)^{n-1}]$$

The sum of the series is

$$a \left[\frac{(1+r)^n - 1}{r} \right]$$

Whence

$$a = VR \times \frac{1}{(1+r)^n - 1}$$

When r , n , and V are known, the annuity a is easily found, for the values of the factor $\frac{1}{(1+r)^n - 1}$ for all ages and for rates of interest at 2, 2½, 3, 4 and 5 per cent. are given in table III, at pages 610 and 611 of the *Traité des bois en France*.

The soil alone produces the first year's growth, the simple annuity, and it would go on doing it every year, but actually it adds the new layer on to the wood of preceding years. The revenue of the soil for 25 years is the sum of 25 simple annuities. This is the ground-rent or share due to the soil. The share due to the wood is more complex. Its development from one year to the next is due to the material already formed. It is thus represented by the compound interest on the annuities.*

If the rate is 3 per cent. or 0.03, and the yield at 25 years is 600 francs, the amount of the annuity is

$600 \text{ fr.} \times 0.03 \times 0.914$ (table III) = 16 fr. 45c. which represents the contribution of the first re-growth. The revenue from the soil, which alone produced this first annuity, and which has produced the same every year, and would have gone on producing the same for 25 years in the open, is therefore, for 25 years, $16 \text{ fr. } 45c \times 25 = 411 \text{ fr. } 25c$.

The share of the growing stock in the production of the yield is represented by the total of the various sums earned during 24 years as compound interest on the various consecutive annuities. They work out to

$$600 \text{ fr.} - 411 \text{ fr. } 25c = 188 \text{ fr. } 75c.$$

In the above example the share due to the soil, the ground-rent, is greater than the amount due to the growing stock. But the ground-rent is not the only producing agent. The wood contributes in very various degrees.

For a simple coppice cut at 18 years, and then yielding 360 francs, the annuity would be 15 fr. 38c. thus,

$$360 \times 0.03 \times 1.424.$$

For a simple coppice cut at 36 years, and yielding 1,200 francs, the annuity or ground-rent would amount to

$$1200 \times 0.003 \times 0.527 = 18 \text{ fr. } 97c.$$

The above examples refer to crops of one age over the whole of the area exploited periodically.

In a coppice under standards cut at 30 years, the *coupe* being worth 600 fr. from the coppice and 900 fr. from the standards cut, the annuity for the coppice would be 600 fr. $\times 0.03 \times 0.701$ (table III) = 12 fr. 62c. The annuity for the standards, supposing their mean age to be 90 years, would be $900 \times 0.03 \times 0.075 = 2 \text{ fr. } 03$. The total annuities, or ground-rent is thus 14 fr. 65c. The share of the growing stock in the production of revenue necessarily increases greatly with time. In this instance, the share due to the soil, being $14.65 \times 36 = 527 \text{ fr. } 40c$., is already less than the amount due to the growing stock, which is 972 fr. 60c.

* Algebraically, the share of the soil in the yield of the *coupe* is as ; and the share of the growing stock is $V - as$.

In a high forest cut at 120 years and yielding at that age 10,000 fr. per hectare (including thinnings and their interest) the annuity at 3 per cent. would be :

$$10,000 \times 0.03 \times 0.055 = 16 \text{ fr. } 50\text{c.}$$

Such are the revenues derived from the soil, the ground-rents, of our high forests, the soil of which is seldom in itself capable of yielding a high return. Great results are only obtained by means of prolonged economy and by the action of the growing stock which goes on growing, and of the forest which fertilises the soil as time goes on. If more convincing proof is desired, it may be found by comparing the revenues derived from pastures or waste lands with those accruing from the broad-leaved or coniferous forests adjoining and by ascertaining the value of land given up by agriculture for reboisement. Hence, it is clear that when the *Recueil méthodique des lois et réglemens sur le cadastre* laid it down that high forest was to be valued at the same rate as coppice, there was certainly no undue favour shown to the former. Probably they did not suspect that there was any difference.

In all the above examples the rate of 3 per cent. has alone been used, to avoid complications. But the rate in practice may be some other, and it is easily seen, on reference to table III above quoted, or by direct calculation, that a lower rate gives a higher ground-rent, and the converse.

There is another consideration. Starting from the sale value of the *coupe*, what is determined is the *gross* revenue. The *net* revenue must be found by deducting the cost of watching, up-keep, plantations, &c.; so that if these expenses amount to 2fr. 50c. per hectare per year, the gross revenue must be reduced by that amount in order to arrive at the true assessable revenue.

The method above analysed supplies the necessary basis for determining the ground-rents of every survey division, apart from any idea of working plans, it is also perfectly applicable to forests under working plans, for it is independent of the age of the wood at the time of valuation.

Private owners of forests have no need to be agitated by compound interest calculations. Any schoolmaster teaching arithmetic can handle them, and they need not be put into practice in order to become explanatory of the facts. The use of algebra is an amusement or a bore, according to the frame of mind one is in. I can to this day recall the scene, when a young B. A. candidate, unknown to me, came up to the black board and was examined as follows :—

"What is the annual payment a necessary to pay off in n years a debt of A , at r per cent?"

No answer.

"Write a , n , A , r ,"

The unfortunate student, writing with white chalk, nevertheless could see nothing but the black board, and remained

dumb, as did the examiner. After two cruel minutes of waiting he was dismissed. I do not know if he knew anything or not, but it would have been easy to find out.

"What happens to an annual payment at the end of a year, 2 years, *n* years?"

"What should be the sum of these payments?"

"Continue."

After all, it was only an affair of summing up a series. Triumph of the schoolmaster *emeritus*, and stupefaction of the candidate, who must surely have learnt it. Never did I see a worse piece of examining. So be not afraid of a black board. There is but an idea to master and here it is.

The annual ground-rent of a wooded soil is nothing more than a simple annuity, while the sale value of the *coupe* includes the accumulated revenues of both soil and stock. That is all. The soil, a natural agent, has a constant action on the wood production. If in time it gains in quality it is by the action of the forest itself, which burrows in it and enriches it. The wood, a natural agent, forms on a given soil an increment every year by means of increasingly numerous organs, leaves, rootlets, &c. Needless to pursue further the analysis of the action of the soil and of the wood by which the value is complicated.

It remains to say a few words, on a most delicate question, that of the possibility. It has been laid down that the valuation of the taxable revenue should be based on the possibility; this is quite right and correct. But how is this amount to be fixed for each survey area, or for a given forest. Every calculation of the possibility depends to a considerable extent on individual appreciation. The first necessity, indeed, is to fix the exploitable age, then the yield in material, and the rates for different classes thereof, so as to deduce therefrom the money value of the saleable *coupe*, 600 francs every 25 years for instance. The fixing of the ground-rent should take count neither of the age of the existing wood, nor of the working plan in force, nor of recent removals of material, nor of the circumstances peculiar to each owner, which the latter may have himself arranged for his own pleasure or convenience. The matter to be determined is the revenue of which the soil is capable, and that with moderation. In a general way, granting the above, the possibility should be based both on the ordinary amount of cutting in the locality, and on the value of wood in the particular forest.

Thus, as the first thing is always to divide wooded soils into classes by fixing the net revenue per hectare to be expected from each, the appreciations of the classifying valuers should be limited to fixing the class to which a given area belongs, irrespective of its actual condition and irrespective of its owner.

Fire-protection in the Minbu Division, Upper Burma.

The Reserved forests of the Minbu Division are exceedingly dry owing to their situation in the "dry zone" of Upper Burma and to their constitution, which is generally a *Acacia Catechu* with a large admixture of such species as *Tectona Hamiltoniana* and *Terminalia Oliveri* and characterised by the prevalence of the Bamboo, *Dendrocalamus strictus*, which loses its leaves very early in the year; so that, as a rule, these forests are almost leafless from the middle of January and in dry years even earlier.

The cover, moreover, owing to the annual fires which have passed over the forest for a long series of years, has been more or less interrupted, and the ground covered with a dense growth of long coarse grass which prevents any natural reproduction, makes the forest very inflammable and increases the difficulty of extinguishing a fire when it has once broken out.

These forests are, therefore, in great need of special fire-protection; they are at the same time difficult to protect, since, in addition to the difficulties presented by the situation and nature of the forest growth, sudden strong winds, of more or less variable direction at first, settling to the south later, are experienced from the beginning of March and last for the rest of the fire season, which commences from the middle of January and ends about the beginning of June.

The prevalence of "Taungya" cultivation and the firing of the forest *outside* the narrow fire-line cleared round the "Taungya" (which is done by the Taungya cutter shortly after he has felled the growth on the area he intends to cultivate, thus fire-protecting the Taungya and preventing the cut growth being prematurely burned) constitutes a real danger from the outside.

The naturally careless disposition of the Burman, and the still more careless nature of the Chin render the passage of these people through the Reserves a source of danger from within, which is considerable, as villages on the borders of the Reserves are very numerous, and journeys frequent during the hot weather, when the people have little work to do, and festivals, Chin drinking parties, and other social meetings help to pass the time.

In one Reserve the simultaneous outbreak of fires in several spots, inside the fire-trace, points to incendiaries and though in that Reserve suspected incendiary fires have unfortunately occurred annually since fire-protection was commenced in 1895, no offender has ever been caught. The theories advanced regarding these suspected fires are various; they may be started by cattle owners for the sake of grazing, or by persons having a spite against some of the fire watchmen, and it has been suggested that they may be caused by right-holders, who in their ignorance think that, if once the Reserve is burnt over, they might possibly

be allowed to extract produce in satisfaction of their rights during the fire season, which is not allowed by the settlement.

The hilly nature of the ground and the want of means of communication add to the difficulties of supervision; the forest staff is also weak, both numerically and in training.

The cost of fire-protection in the Minbu Division is unavoidably kept up by the scattered, isolated disposition of the Reserves (which could not be taken up in large blocks owing to numerous intervening villages). The Reserve boundaries, also, do not favour fire-protection; as the exclusion of low lying lands (called "kyins" and suitable for cultivation) at the bends of the streams and at the mouths of feeders diverts the boundary from the main stream banks, thereby increasing the length of artificial fire-lines. Labour though abundant, is, as usual in Burma, highly-paid, unskilled coolies earning Rs. 12 per month or As. 8 a day if hired for short periods.

Such were the conditions under which fire-protection was commenced in 1895, when an attempt was made to protect the Tichaungwa Reserve—14,080 acres. But before the fire-lines were completed, fire spread into the Reserve and a large area was burnt over. A second big fire occurred later and eventually only an estimated area of 3,200 acres escaped. The cost of the work was Rs. 736.

It is to be noted that villagers called upon to assist in putting out the fires refused to obey. They have in more recent years been educated into rendering assistance.

In 1896 the Tichaungwa Reserve fire-protection was much more successful. The northern part of the Reserve was excluded from the protected area as it was thought that the grazing to which it was subject was a source of danger; the area over which protection was attempted, was thus reduced to 11,520 acres, and fire was kept out of 10,240 acres. The 1,280 acres estimated as burnt over suffered through incendiary fires. The cost for the year was Rs. 962.

In 1897 the same portion of the Tichaungwa Reserve was fire-traced, but the result was exactly the reverse of the previous year. Fires occurred at intervals from January to April and were thought to be incendiary; 10,240 acres were burnt over and only 1,280 acres escaped. The cost of protection was Rs. 701.

In 1898 protection was again attempted over the same area of the Tichaungwa Reserve, but the fire-traces were widened and proved effective, as in no case did fire cross any of them. Five fires occurred during the fire season, and 1,472 acres were burnt over; the cause of none of these fires was proved, but they were probably incendiary, as they all commenced inside the fire-traces and at a distance from them.

A portion (4,160 acres) of the Mon west Reserve was placed under fire-protection in 1897 and the whole escaped fire. The cost was Rs. 558. The same area was again protected in 1898

(with the exception of 14 acres which were burned through carelessness when firing the trace) at a cost of Rs. 455.

The only other fire-protection undertaken up to this year (1899) was to protect isolated cutch plantations and this was successful, but the area dealt with was small.

This year, fire-protection was attempted over the usual area in the Tichaungwa Reserve, extended over a very much larger area in the Mon west Reserve, and 12 square miles of the Pazu Reserve were, for the first time, brought under protection. The results cannot yet be noted but it may be mentioned that several incendiary fires have unfortunately occurred in the Tichaungwa Reserve.

There can be no doubt of the very great importance of extending fire-protection in these forests. The main difficulty lies in the want of a better trained and more trustworthy subordinate staff, and this we hope will result from the Burma Forest School, long talked of and now soon to be established.

C. F. MURIEL,

BURMA,
16th May 1899.

II.—CORRESPONDENCE

A Note on Changa Manga.

SIR,

The visit of the Forest School to Changa Manga last January was specially interesting, because it was the first year of the second cycle of coppicing, *i. e.*, the seedling plantation has been cut over once, and *coupe* No. 1 for the second time. It was therefore desirable, if possible, to see if there were any signs of diminished vitality among the stools. In the absence of any exact information recorded during the first rotation, the answer to the above question cannot be a precise one. So much answer as there is must be extracted from the solution of the next question, which was as follows; *viz.*, at what age or size do mulberry stools begin to lose their power of producing shoots? In order to solve this question, every consecutive stool was measured in portions of compartments 1 & 2 of the *coupe*, so far as time allowed. The results are not so instructive as might have been expected.

The vitality of the stools in compartment No. 1 is at first sight appreciably greater than that of those in compartment No. 2. In the latter some quite small stools failed to coppice, while in the former no failures appear below 7 inches. In the latter the failures mount up to 53 per cent. While in the former they are only 50 per cent. The extra 3 per cent. consists of *young* stools. The number of shoots per productive stool averages 25 in No. 1, while in No. 2 it is only 19. On the other hand, No. 1 contains several more stools that have failed to consider how they shall support their numerous progeny. As this may be due simply to grazing, it is evident that too much stress cannot be laid on the percentages of shoots. The more frequent failure of young stools in No. 2 has just been noticed; it is counterbalanced by a superior vitality in the older stools. If we consider the stools above 12 inches in diameter, we find that in No. 1 only 35 per cent. produced shoots, while in No. 2 the living stools reach 50 per cent. Here at last is a fact which is useless to me, but has its importance for my good friend the local Forest Officer.

Reverting now to the original question as to the age of coppice exploitability, it is seen that the answer is by no mean obvious. There is, indeed, a marked failure of vitality among the larger stools, but where is the line to be drawn? Although the ages as counted run from 8 to 18 years, there is much probability that practically the whole of the stools were aged 15 years, neither more nor less. At any rate the counted ages give no grounds for any useful conclusion. I have not proved this but it looks, indeed, to me as if the result of such a count would be to show that the *younger* stools were the *least* useful. We are, therefore, reduced to the basis of *size*, and now the paradoxical result appears that the most vigorous stools are the least useful, or in more precise words the faculty of reproduction is not proportionate to that of vegetation. Carefully considered, this is an unexpected fact, and I am not sure by which end to lay hold of it. The well known case of a tree sometimes running to leaves instead of fruit is not truly analagous, yet there is a temptation to substitute the word *shoots* for the word *leaves*, and to account for the fact by saying that in both cases the tree was too busy assimilating the things of this world to make due preparation for the next. Anyhow, it is clear that the fattest are not the fittest. Twelve inches in the one compartment and nineteen in the other, seem to be about the limits of fatness beyond which the individual cannot be relied on to continue the species.

The next point on which information was sought regards the comparative rates of growth of sissu and mulberry coppice shoots in their early years. It has hitherto been stated, simply, that mulberry being the faster grower, crushes out the sissu. While in the main true, this statement is not absolutely exact, as is shown by the following figures.

Compt.	Age.	Sissu.			Mulberry.		
No.	Yrs.	No. of shoots measured	Cumulative height.	Mean height.	No. of shoots measured	Cumulative height.	Mean height.
1	1	135	902	6' 8"	162	1002'	6' 2"
123	1	1132	7564	6' 8"	656	4080'	6' 3"
120	2	939	9502	10' 1½"	355	3221'	9' 0½"
100	4	808	15187	18' 10"	208	4038'	19' 5"

It is thus evident that, in this locality and under these conditions of watering, &c., the sissu leads for the first three years but is then overtaken by the mulberry.

The standards in compartments 1 & 2 were measured as follows, sissu only and reserved on stools.

Compartment.	Age.	No. measured	Mean girth	Mean height.
1	16	417	35 ¼'	...
1	16	217	..	46'
2	16	474	35½	...
2	16	222	..	53'

Mean 35½'

50'

The following figures give the measurements of sissu coppice-shoot standards taken as we wandered about, and therefore do not represent true averages.

Compt. No.	Age.	Girth	Height.	Compt. No.	Age.	Girth.	Height.
7	15	4' 8"	—	53	less than 30	6' 7"	— *
		4' 10"	—	58	Do.	5' 2"	— †
		2' 11"	—	64	Do.	6' 5"	— † ‡
		2' 6"	50	Do.	Do.	5' 3"	— †
		2' 6"	48	Do.	Do.	7' 9"	81— †
		3' 0"	—	72	Do.	6' 7"	65— †
		3' 3"	55	Do.	Do.	6' 10"	80— †
		3' 0"	50	Do.	Do.	7' 4"	70— †
		3' 6"	61	100	Do.	6' 2"	80 † †
		3' 0"	45		Do.	6' 2"	75 † ‡
8	15	3' 4"	53				
		3' 2"	60				
		2' 7"	54				
		3' 4"	60				
		3' 7"	56				
		3' 0"	50				
		2' 8"	51				

* Timber contents = 79 cft.

† Trees growing in close proximity to water channels. Away from such channel the standards average below 30" girth.

‡ Cover = 38 × 50 = 1500 sq ft.

Cover = 38 × 44 = 1320 sq ft. = 38 trees per acre.

§ Cover = 48 × 44 = 1662 sq ft. = 26

„

The largest mulberry shoot found girthed 7' 0" at base and 5' 11" at breast height, though only 15 years old. A *bakain* aged 16 girthed 4' 4" at breast height. Besides the above, the mean of 4 *tun* stems aged 16 in Nos. 1 and 2 gave a girth of 2' 1½" and a height of 46 ft. A mulberry in No. 95, dominant but not very exceptional, aged 5 years, had a girth of 1' 9½" and a height of 26 ft. Its cover was 284 sq. ft. and was taken for comparison with the sissu. Mulberry takes up far more growing space than sissu, gives a far higher proportion of useless twigs, and does not sell so well. Merchants pay more for sissu, and grumble when stacks contain much mulberry. The twigs which cumber the *coupe* cost a lot of rupees and give a lot of trouble to clear off the stools and burn. The supplanting of sissu by mulberry is therefore a serious matter, and the idea that Nature may be left to work out its own salvation, is not one that can be accepted without carefully counting the cost in each case.

The average annual production of Changa Manga for the last 14 years, taken on the whole annual fellings, exclusive of the brushwood burnt, works out to 68 c ft. solid per acre per annum, a very fine result indeed, all things considered.

Before closing these notes, I have to challenge the statement of those who say that Changa Manga is "an expensive luxury". With all deference, it is a necessary luxury, and not expensive at all. It is true that, by including all the preliminary attempts and failures the plantation is burdened with, a heavy capital outlay is arrived at, which reduces the profits (theoretically) to small dimensions. But after all, the small profit is mainly due to the action of the Irrigation Department, which diminishes the supply of water and increases the demand for money as often as it can. Originally the plantation was created at the tail of the canal in order that any surplus water running to waste should be used for it; and a lump sum was paid for such water and on condition that it was only taken when cultivation had no use for it. Then, it was discovered that the plantation was absorbing a large volume of water, and the plantation was, I understand, charged at a rate per quantity of water, as if it were not waste at all, and, but for its being taken by the Forest Department, would be available for, and utilized by, the surrounding cultivators. The conclusion is that the plantation is answerable for putting a value, probably an excessive value, on water which cannot be used for any other purpose.

If it be true that plantations are to be made at Lyallpur by the Irrigation Department, it might be well to compare the strip of land bisecting Changa Manga, managed by the Canal Department, with the rest of the plantation. It is perhaps the best watered land in the whole tract, and as the rate of growth depends directly, and almost solely on the water-supply, it follows that the financial results depend on the quantity of

water and the rate charged for it. When this comes to be fully considered and weighed, it will not be found that the Irrigation Department can compete, either financially or otherwise, with the results already in evidence at Changa Manga.

F. G.

Sex of Deodar trees.

SIR,

In the sylvicultural sketch on the Deodar published in the April number of the *Indian Forester*, I see it is stated that male and female flowers are not found on the same branch.

This is, no doubt, the rule; but last year in Jaunsar I observed fully half-a-dozen cases in which both cones and catkins were found on one and the same branchlet, and within a few inches of one another.

Bi-sexual trees are also far from rare. There is a tree, for instance, standing within 50 yards or so of the Konain forest bungalow, every branch of which, *except two*, was loaded with male flowers in 1898. These two branches bore female cones but no catkins and they have been marked with small tin plates, in order to see if they retain their sexual character permanently.

B. B. O.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Podophyllum Emodi.

The Inspector-General of Forests has recently issued a Circular to Conservators drawing attention to the value of the roots of *Podophyllum emodi* (vide Imperial Institute handbook No. 3), and suggesting that every endeavour should be made to start a trade in it with the drug merchants of Bombay and Calcutta. It has been reported from the Imperial Institute that it has been proved that the Indian drug is a complete and satisfactory substitute for the American product (*P. peltatum*), the chemical constituents of the former being identical, both in their composition and action, with those of the latter. The

development of the utilization of *P. emodi* for the extraction of "podophyllum," for which there exists a considerable demand in English and Continental markets, is therefore a matter of some importance, and enquiry is made as to what steps can be taken to secure the object in view.

Salem Iron Ore and Sanctoria Coal.

The following memorandum by Professor Dunstan of the Imperial Institute is abstracted from correspondence communicated by the Madras Government.

Memorandum on the trials by Messrs. Bolckow, Vaughan & Co. of samples of Salem iron ore and Bengal coal.

In connection with the correspondence which has taken place between Mr. H. G. Turner and the India Office with reference to Mr. Turner's application for a concession to smelt the Kanjamalai ore, I wish to draw attention to the following points.

In 1892 Mr. T. H. Holland, Assistant Superintendent of the Geological Survey of India, was deputed by the Government of India to secure for the Imperial Institute a representative collection of the iron ores of Madras. In transmitting the collection of samples Mr. Holland suggested that they should be experimentally examined (*see* Sir E. Buck's demi-official letter, No. 1088-29, to Sir Frederick Abel, dated 5th May 1892, F. S. S., No. 26).

The specimens were accordingly submitted to analysis in the laboratories of the Imperial Institute, and the result published in the Journal of the Imperial Institute, volume 2, No. 18 (June 1896).

This collection included six samples of ore from Kanjamalai in the Salem district of Madras, which, on analysis, furnished the following results:—

Number.	Available iron.	Insoluble residue (Silica).	Lime.	Sulphur.	Phosphorus.
799	68·95	1·04	...	·16	·13
815	70·06	1·72	...	·20	...
873	63·57	8·89	...	·29	...
874	66·90	3·17	...	·10	...
812	36·44	46·95	...	·10	...
813	35·73	48·45	...	·29	·27

The average percentage of available iron is thus 56·95, the highest percentage being 70 and the lowest percentage 36. Out

of the six samples, four were therefore of excellent quality and only two inferior. The four samples are undoubtedly suitable for conversion into pig iron by smelting on the large scale, whilst the two samples are valueless for this purpose.

A specimen of the consignment of ore specially selected this year by Mr. Middlemiss, of the Geological Survey of India, for transmission to Messrs. Bolckow, Vaughan & Co., as typical of the Kanjamalai deposit, referred to in his memorandum of the 6th February 1898, furnished on analysis in the laboratories of the Imperial Institute the following results, which are in substantial agreement with those obtained by Messrs. Bolckow, Vaughan & Co., and recorded in their letter of the 28th July 1898 (*see* appended report on Salem ore and Sanctoria coal by Mr. J. E. Stead). In the following table, column 1 gives the results of the analysis made in the Scientific Department of the Imperial Institute, column 2 the results of Mr. Stead :—

	Imperial Institute.	Mr. Stead.
Iron ... ..	... 38·74	39·02
Insoluble residue (silica) ...	... 44·09	42·36
Lime ... ..	.. 365	1·00
Sulphur ... ..	... 0·76	0·03
Phosphorus ... ..	... 14	13

It is therefore clear that the specimen of Kanjamalai ore, regarded by Mr. Middlemiss as representative, is extremely poor and quite unsuitable for smelting in the blast furnace. In connection with the favourable opinion expressed by Mr. Jeremiah Head in his report to the Secretary of State, dated 11th March 1898, as to the possibility of smelting the Kanjamalai iron ore, it should be pointed out that he has taken, as provisionally representative of the ore, the results of the analysis of the best specimens from the Imperial Institute set, and has taken no account of the recorded results of the analysis of the two inferior specimens (Nos. 812 and 813) which correspond with the samples regarded by Mr. Middlemiss as an average representative portion of the Kanjamalai deposit.

Turning to the coal. One hundred tons of Bengal (Sanctoria) coal were forwarded to Messrs. Bolckow, Vaughan & Co. A sample from this consignment analysed in the Scientific Department of the Imperial Institute furnished the following results :—

Calorific value—6,237 calories.
 Fixed carbon—52·83 per cent.
 Volatile matter—25·94 per cent.
 Sulphur—1·68 per cent.
 Phosphorus,—0·039 per cent.

These results again are in substantial agreement with those obtained by Messrs. Bolckow, Vaughan & Co., from Mr. R. Robinson, and referred to in their letter of 28th July 1898. This

sample of Sanctoria coal is, however, inferior to the two samples described in my "Report on the Coal Supply of India, 1898," which were sent to the Imperial Institute as representative of the coal of this colliery. The analysis of these two samples gave the following results :—

	Serial number.	Fixed carbon.	Volatile matter.	Sulphur.	Ash.	
	1,163	49.4	39.3	1.63	11.29	
	1,168	49.32	39.94	1.53	10.74	

It therefore appears that the consignment of coal sent to Messrs. Bolckow, Vaughan & Co., whilst containing a smaller proportion of sulphur, is much richer in mineral constituents (ash) than either of the two samples referred to in my Coal Report, there being, in fact, nearly twice as much ash in the coal consigned to Middlesborough, which, moreover, is stated to yield an unsuitable coke. Consequently I agree with Messrs. Bolckow, Vaughan & Co., that this sample of Sanctoria coal is unsuitable for smelting purposes.

We may, therefore, conclude that if the sample of Kanjamalai ore is, as Mr. Middlemiss asserts, an average specimen of this deposit, this ore cannot be seriously regarded as suitable for smelting, even after treatment by the magnetic separator. Similarly, if the sample of Sanctoria coal sent to Middlesborough is the only coal available for use in the blast furnace, then iron smelting can hardly succeed in Madras.

I am, however, of opinion that neither of these two points has been established. As regards the ore, Mr. Middlemiss remarks :—

"Only occasionally, in small pockets or as veins or local accretions (not more than a few inches across), do we sometimes find masses of pure, or almost pure, magnetite. But it would not be fair to include these in any estimate of the general richness of the beds. It is doubtless due to some such specimens as these having been gathered that some of the analyses of the Kanjamalai ore carried out at the Imperial Institute gave such abnormally rich percentages of iron (about 70 per cent)."

Now, the specimens of ore referred to by Mr. Middlemiss as having been analysed at the Imperial Institute were selected by Mr. T. H. Holland as typical portions of the deposits. Four out of the six specimens are undoubtedly excellent samples of magnetite, which would repay smelting, whilst only two were of the inferior quality regarded by Mr. Middlemiss as representative. It is evident that, before any conclusion can be arrived at as to the value of the Kanjamalai deposit, it must be systematically sampled and analysed. I agree with Mr. Jeremiah Head's recommendations on this head.

As to the coal, I have no information with reference to the selection of the sample sent to Middlesborough. As I have pointed out, it is inferior to the sample of Sanctoria coal specially selected for analysis at the Imperial Institute by the Reporter on Economic Products to the Government of India. Of the 53 samples of coal derived from the various Bengal collieries and described in my report, a number would probably be suitable in composition and coking power for use in smelting iron ores.

The fuel question, therefore, requires further investigation before any decision as to the suitability of Bengal coal can be arrived at.

10th November 1898.

↳ Rubber*from the Ceara Rubber tree in Madras.

In reply to a communication from the Board of Revenue, Madras, relative to the extraction of rubber from the Ceara rubber tree (*Manihot Glaziovii*) Mr. D. Hooper, Officiating Reporter on Economic Products to the Government of India, wrote in December last as follows:—

“I do not think I could do better than enclose a copy of ‘my report on the analysis of a few pounds of the powdered bark ‘received from Mr. Proudlock in October last. The results of ‘the experiments show that the scheme of preparing rubber from ‘the dry bark of this introduced tree is impracticable.

‘I have since made a microscopical examination of the ‘inner bark with the result that, while the laticiferous vessels or ‘caoutchouc ducts are not absent, they are scantily distributed ‘in the bark and are undeveloped and in some cases empty.

‘While the cultivation of the ceara rubber trees has been ‘fully established in Southern India, it is a matter for regret ‘that the climatic conditions or soil are not suitable for encourag- ‘ing the secretion of rubber in the trees to make their introduc- ‘tion a commercial success.

COPY of report on the analysis of the powdered bark of ceara rubber tree (*Manihot Glaziovii*), by D. Hooper, Esq., F.I.C., F.C.S., F.L.S., Officiating Reporter on Economic Products to the Government of India.

In October last a sample of a few pounds of ground bark from the ceara rubber tree was received from Mr. Proudlock, Curator of the Botanic Gardens, Ootacamund.

NOTE. The facility with which the tree grows in certain localities in South India where the tree has been experimentally planted, encouraged the hope that the juice would be secreted in large quantities and the raw rubber made available for the home market. These expectations were

not realised, since it was found that several well-established trees refused to "bleed" when the bark was cut during the dry weather, and the small quantities afforded by other trees growing in more favoured situations were not sufficient to pay for the expenses attending their cultivation.

It was next thought probable that the rubber might be extracted by some simple process from the stem bark of the mature trees.

An experiment was made in this direction in 1886, when Mr. L. Wray, Junr., of Perak, forwarded to London a sample of bark of *Paysona Leerii* (*Gutta Sundeh*) for valuation and report. The bark was duly analysed and found to contain over 13 per cent. of gutta and resin. The recovery of the rubber by means of solvents involves such a loss that it was considered at the time that the material was useless and the process of separating the rubber was too expensive.

The bark in question was boiled, for two hours with benzol, the solution filtered and the solvent recovered by distillation. The residue was treated with spirit to dissolve adherent resins, and the caoutchouc weighed. The amount was equal to half of one per cent. of caoutchouc on the air-dried bark. Another estimation was made with boiling chloroform in the ordinary way, and the total dry resinous extract obtained by means of this solvent was less than one per cent.

The cultivated ceera rubber bark contains such a minute proportion of rubber that it would be useless to endeavour to extract it by artificial means. The bark operated upon contained 12 per cent. of water and a large quantity (17.5 per cent.) of mineral matter. A trace of tannin, a little red colouring matter and some starch were the only other noticeable constituents in the material.

Death of Mr. Gregory Quinton Corbett, Dy. Conservator of Forests.

We have received with much regret the news of the death, from remittent fever, of Gregory Quinton Corbett, Deputy Conservator of Forests. It was Corbett's intention to have gone home early in May to recruit his health, which had become impaired; but it was not realized that his life was in any danger, even while he was suffering from fever, until quite at the last when a weakness of the heart, originally contracted during an attack of rheumatism, rapidly developed and brought about his death on the 22nd of April at Thayetmyo. Corbett, who was 34 years of age, had served in Burma ever since he joined the service in December 1886. He was one of the last batch of English students trained at Nancy, and promised to hold his own with the ablest of those many Forest Officers, whom l'école forestière has supplied to India and Burma. His premature death, after only twelve years' service, is a loss to the

administration, and particularly to the department in Burma. He had served in several districts in Lower Burma, where he had proved himself extremely conscientious, zealous and hard working. His devotion to duty often led to a want of consideration for his health, and the indefatigable energy with which he managed and developed the working of the Tharramaddy Division, where the greater part of his service was spent, is believed to have conduced largely to his untimely death.

IV.-REVIEWS, &C.

Forest Administration in Bengal, 1897-98.

The Conservator's report is unnecessarily long and detailed, running into 34 pages of print instead of being confined to the prescribed 20 pages. The area of reserved forests is as yet only 3.9 per cent of the area of the provinces, and it is satisfactory to notice that an addition of 842 square miles is about to be made to them in the Chittagong Hill tracts, and that the Government of India advocate further reservation of the unclassified forests of those parts which are being rapidly destroyed by "jhuming." We should have been glad to find the expenditure incurred during the year in the areas undergoing settlement included in Form No. 47, for which columns 14 and 15 are provided.

The amount expended points to the repairs of boundary marks being properly attended to, but the Conservator's remarks "that an inspection of the boundaries of a division cannot be attempted annually for want of time: parts are inspected as opportunity occurs," are not understood. Surely the forest Guards have time to inspect all the boundary marks within their beats, at any rate once a year. The information regarding the extent to which the prescriptions of existing Working Plans are carried out is meagre and little progress is being made in the preparation of new ones. It is most satisfactory to find the Local Government alive to the urgency for, and value of, Working Plans. The following observation is most apt. "Without the definite information which plans of even the rudest and most summary description give, it is difficult for the Department to judge what can, in an individual forest be done, and what it is wise to leave undone; and without them it is altogether impossible for the Government to judge, whether or not, the action of the Department is right." This is most true and by way of example we venture to ask what weighty considerations have caused the Department to abandon the market for 'sâl' sleepers, so successfully opened up in recent years by means of a supply from the Singbhum Division to the

Rai Bareli—Benares Railway, and how far the Government is satisfied that the action of the Department, in terminating sleeper operations in those forests, is justified by the possible yield and other demands upon that yield. We have an idea that the compilation of a Working Plan for the 732 sq. miles of reserved forest in the Singbhum Division was taken in hand some years ago, but the work would now seem to have been dropped, as no entry of its being in course of preparation appears in Form No. 50. The inferiority of the means of export and the desirability of cheapening and extending the existing methods of transport have attracted the notice of the Lieutenant-Governor; but, when a good cart-road in the Singbhum Division takes several years to complete over 13 miles, and its completion is consummated by an expenditure of Rs. 306 on the making of a mile-and-a-half, it is readily seen that progress in this direction is much too slow. We should have supposed that the making of this road straight off, and of others too, while the sleeper operations were in progress, and not after their termination, would have materially facilitated their extraction.

Forest offences show a considerable increase and there is something at least curious in the assumption, on the one part that the more vigilant supervision of the local officers should be answerable for an increase of 703 in the offences brought to light, while on the other these same officers allowed 185 cases to go 'undetected' as compared with 59 in the previous year. We should be glad to learn on what grounds 173 cases of injury to the forests by fire are ascribed to offenders whose detection was not effected. Is it not probable that the injury was more often due to pure accident, or to carelessness on the part of the staff rather than to incendiarism or punishable neglect of rules? The increased number of cases in the Singbhum Division is in some mysterious way attributed to increased activity in one of the ranges, much subject to petty speculation *since the promotion of the officer in charge*. The name of the officer upon whom promotion has had this peculiar effect is not given. A tiger earns the ambiguous commendation of having killed a man while illicitly cutting a tree in Angul.

The unsatisfactory results of fire-protective measures are sufficiently reviewed by the Government of India as follows:—

"Of late years in Bengal, a year in which fire-protection is satisfactory has been followed by a year in which measures taken to protect the forests from fire have proved unsuccessful. During the year under review 27 per cent. (529 square miles) of the area over which special protective measures were in force (1,958 square miles) were burnt over. In the previous year, only 62 square miles or 3 per cent. were burnt over. The largest area under protection is in the Singbhum Division, where special measures of protection were in force over an area of 732 square miles, of which no less than 436 square miles or 59 per cent. were burnt over during the year. In this Division protective measures on a large scale began in 1891-92, when the area under special

protection was raised from 215 square miles to 782 square miles. The whole area of reserved forests in the Division is believed to be now under fire-protection. The results have not been satisfactory, inasmuch as that in 1892, 29 per cent., in 1894, 86 per cent., in 1896, 64 per cent., and in 1898, 59 per cent. of the area attempted to be protected have been burnt over. This is the more to be regretted in that the forests of the Singbhum Division have lately been subjected to very heavy fellings which, followed by such conflagrations, must have reduced them to a very unsatisfactory condition. Protection such as this is probably worse than no protection at all, not only because a forest protected for one year and burnt the next is generally in a worse state than if burnt annually, but also because it encourages a general feeling amongst the surrounding people that the customary burning of the forests cannot be put a stop to. The Government of India are inclined to believe that the area under protection may have been increased too quickly, and they would prefer to see a smaller area, effectively protected, rather than ineffectual protection over an area which appears to be beyond the power of the establishment to keep from being burnt."

The utter destruction of the Sitapahar teak plantation in Chittagong by the cyclone of 1897 is well shown by a counting over 305 of the 660 acres, on which out of 6,672 stems no fewer than 4,163 were found to have been up-rooted and 2,509 badly broken. It is worthy of note that the damage was least where the teak was mixed with other species. There seems to have been unnecessary delay in removing the debris and cutting back the damaged stems. The chief cultural operations took place in the Darjeeling Division, where 573 acres were treated at a cost of Rs. 96,00. This is satisfactory; but the work of planting up the 'coupes' seems to have been allowed to fall into arrear owing to insufficient plants being raised in the nurseries. This is to be regretted, because the longer the work is postponed the more difficult it becomes; and advantage should be taken of any good seed-year to raise an ample stock of plants for making good whatever ground has been lost.

Experiments with Robinia and Deodar in the Darjeeling Division have not proved successful, while it is noted that seedlings of walnut and Spanish chestnut are thriving.

The report is not at all full under the head of exploitation. Under selection fellings in the Singbhum forests the Divisional Officer reports.

"The selection fellings for the purpose of supplying broad gauge sleepers from trees over 6½ feet in girth were continued during the year. The total number of trees felled during the whole progress of the sleeper operations is calculated at 20,921, from which the number of trees felled during the present year is calculated to be approximately 2,427 at the average of 10·4 sleepers per tree. The fellings, which have greatly impoverished the forests, have been fortunately concluded."

Supposing a register to have been kept as prescribed by Section 30 of the Forest Department Code, it is difficult to follow the calculations that were necessary in order to arrive at the number

of trees felled, and unless the Divisional Officer has worked out the possible yield, it is not very clear on what grounds he can assert that the felling of 21,000 trees, spread over several years, has greatly impoverished the forests. Had it been said that the possibility of the forest works out to only 2,000 first-class trees a year, and that the yield of 10½ years had been removed in 3 years, we might have joined in his gladness that the fellings were concluded. As it is, we incline to the view that the forests should be effectively fire-protected at a cost to be covered by the profit to be derived from the possible annual yield in broad gauge sleepers, for which apparently some 6 annas per foot of sawn timber, or say, 3 annas per foot of timber in the round, are to be derived. The net value of the timber might even be greater, if some of the many miles of *kutch* hilly roads were converted into good cart-roads.

The development of the trade in minor forest produce, such as sabai grass, gōlpatta, hantal and mica is noticed by the Government of India as very satisfactory.

With the exception of the Sunderbans Division, which may be relied upon for a surplus of 3½ to 4 lakhs a year, the Singbhum Division, which we are led to understand has been worked for sleepers beyond its capabilities, and the Chittagong Division with its substantial income from bamboos (Rs. 34,584), which is said to be declining, all other divisions were either worked at a loss or at a surplus of a few thousand rupees, in no case exceeding Rs. 14,000. This clearly indicates the necessity for developing the markets for whatever timber and produce may be available, not only by the improvement of the means of export, but by the utilization of the possible yield of the forests to its utmost, wherever a demand at remunerative rates exists for it.

Hyderabad Forest Report (1896-97).

The Resolution of the Board of Revenue of the Nizam's Dominions on this Report is dated 16th February 1899. Our notice, therefore, is not so late as it would at first sight appear. Though the Forest Department in the Dominions was apparently started a good many years ago, the organisation of the forests is but half completed and their administration very backward. The forests are of two classes, Reserves (closed forests) and open forests. As regards the former, disputed boundaries with *jagir* lands and undefined boundaries of interior cultivation were delaying their settlement. Some 210 miles of demarcation (out of a total of 811 miles) chiefly along *jagir* boundaries, remained to be done; a most important work in view of the frequency of illicit fellings along the latter. Surveys were also proceeding slowly. The Reserves cover an area of 3,881 sq. miles and supply

considerably less than half of the gross revenue. The open forests which supply the remainder are of apparently, unknown but very large, extent; they are under joint management, there being 16 species reserved and under the control of the Forest Department, while for the remaining produce passes are issued by the Revenue Department.

The chief interest in the Report consists in the references to the condition and future of the open forests, an all-important question. We can well understand that with many conflicting interests, the Nizam's Government finds the wholesale or partial reservation of these tracts a difficult matter to decide upon; as also that a *large* increase in the forest establishment cannot readily be acquiesced in. But when we read that these forests "are annually diminishing in area and deteriorating in quality," though "most of the valuable forests tracts are still in the open forests," that no establishment is kept up by the Revenue authorities, while that "maintained by the Forest Department is inadequate to protect the reserved species," that ryots who are entitled to free timber, etc., sell the surplus of what they take out and do not require themselves, "whilst as a matter of fact the general public take what they require (among unreserved species) without payment, cutting in a reckless and extravagant manner;" and finally from the Conservator's complaints of the numerous serious illicit fellings made chiefly along the boundaries of *jagirs* and *maktas*, and sometimes accompanied by extreme lawlessness,—it is evident that the administration is carried on with great laxity and that the Department gets all too little help from the Revenue authorities.

To return to the question of reservations. The Conservator advocates a system of ultimately creating reserves up to 10,000 miles, for fuel and fodder as well as timber: with this would be required a largely-increased establishment, part of which was sanctioned (but never appointed) just before the famine. At the time of his report being forwarded proposals for reserving 2,145 miles were up before Government and others for reserving nearly 3,000 more miles were ready for submission. The Government has since then reserved 860 miles of the former, but does not apparently intend to go to work on the large scale proposed by the Conservator. The Board of Revenue states that the establishment is—and must remain—too small for such a large scale of work, and that it will be better to increase the number of reserves and hand over the remainder to the Revenue Department; that the recent increase of reserved species from 8 to 16, while it has done much good to the forest, has naturally caused discontent among the ryots, while it also advocates a better understanding between the Revenue and Forest Departments. We are quite at one with the Board in this, but at the same time it is evident from the Conservator's report that much of the illicit felling is due to the listlessness and unsympathetic attitude, and often collusion, of the smaller Revenue officials. If the latter

are to give passes for forest produce, they require a commission and a larger one than 5%. As regards the larger question, it is noted that the expenditure has increased by Rs. 45,000 and the gross revenue by Rs. 1,42,000 in 10 years. An increased establishment would give better protection and more revenue. We take it that one of the reasons for preserving forest growth in the Deccan is, not least, climatic. If the Government is determined to have a smaller number of reserves, at least let these be properly protected, and for the remainder any protection is better than no protection; let the Forest Department, or even only its Upper Executive and Controlling Officers look after these in conjunction with the Revenue officials (especially the smaller ones) who should be given a larger stake in the success of the forest administration. Lawlessness should be put down with a firm hand.

It was said above that administration is backward. There are no working plans, though one for 123 miles is proposed on the coppice-with-standards system and 30 years rotation for fuel. Felling level with the ground is laid great stress on—with good results in coppice shoots.

Under "workings of the year," we note there is little provision for buildings and still less for roads. Up to the present even the Conservator has not been allowed to spend any money on the latter without special sanction. The Divisional Forester Officer, Warangal (the most important of the four Divisions), states that two-thirds of his forests are unworked because there are no roads. This is an impossible method of working.

Under "protection of the forests from injury," Rs. 16,521 were realised as compensation for illicit felling in 2,295 cases, an increase on the previous year, due to four times the value of the stolen property instead of twice only, being allowed to be taken. 1632 cases were reported from the Bider Division alone, and this, apart from the fact that many cases were not reported. "Many thefts of the boldest character were reported and some forest guards were severely handled." (The Divisional Forest Officer of Bider for the last seven months of the year, put in 17 days in camp in the whole year!) There were 47 Court cases, of which 12, including 4 convictions, were disposed of and 35 left pending! Of one case against a *jagirdar* for stealing timber it is remarked that "it was the first case of its sort in which it has ever been found possible to get a conviction." What further comment is necessary! A Forest Act, drafted on the same lines as the Berar Forest Act was before the Legislative Council at the end of the year. It is badly needed! Fire-protection was started during the year. Even in this famine year most of the forests were burnt, with disastrous effects to the cattle, of which it was estimated that in the Bider Division only 20 to 30% survived, while the price of grass went up enormously. Deploable damage was done to all species in Government forests in the efforts of the villagers to save their cattle by pollarding

the trees. We are very far from agreeing with the Board in their policy of auctioning reserves for grazing.

As regards the exploitation of forest produce, 73% of the timber comes from open forests. The free grants of unreserved timber, of which no exact account is kept by the Tahsildars, are of immense quantity, of which a considerable proportion are sold. In the Bider Division there is an enormous consumption of poles for sugar cultivation, 8,000 being required per bigha.

With regard to revenue, there was a fall in timber and rise in grazing dues, the gross revenue being Rs. 2,02,547 or more than has ever been received before. Of this the Reserves gave Rs. 78,208, of which Warangal showed Rs. 54,275. The surplus was Rs. 76,219. In addition, over Rs. 57,000 were collected by the Revenue Department, of which Rs. 39,619 were received for Cassia bark. Further, the amount for Gulmohwa (*Bassia latifolia*) was credited to the *Abkari* Department.

Y. F.

In the Forbidden Land.

By Henry Savage Landor.

It is nearly eighteen months now since Mr. Henry Savage Landor returned from his travels in Thibet : but the Rougemont fiasco and the recent correspondence between Mr. Landor and the Secretary of the Royal Geographical Society regarding the geographical inaccuracies contained in his book, *In the Forbidden Land*, has caused a great deal of attention to be drawn to the achievements of this remarkable traveller. Sufficient has appeared to show that Mr. Henry Savage Landor is in no way to be trusted as regards the scientific results of his travels ; but Forest Officers who frequently have to undergo great hardships, who frequently have to put up with many discomforts in the ordinary course of their duties, will read with great interest, if not with amusement, of some of Mr. Landor's exploits, which have been collected from the pages of his book.

The Forest Department doubtless contains many officers who are renowned for their walking capabilities. Many authenticated stories could be related. It will be sufficient to mention the exploits of the young forest officer in the Chanda District, of the Central Provinces, an ardent shikari, who, having received *khulber* late in the evening of a tiger-kill, at once started off and walked over 50 miles during the night to shoot his tiger in the morning. Such officers will appreciate Mr. Landor's achievements ; especially as they were, without exception performed under the greatest climatic difficulties.

Thus, for instance, on page 166 of his book Mr. Landor relates his adventures at 22,000 feet elevation.

"Exhausted and seized by irresistible drowsiness, the Rouba and I, nevertheless, at last reached the top. Although almost fainting with fatigue, I registered my observations. The altitude was 22,000 feet, the hour 11 p.m.

The ascent from the glacier at the bottom of the mountain to the summit occupied $4\frac{1}{2}$ hours; the precipitous descent, without counting stoppages only the ninth part of the time. Over the same trying stony valley we reached camp during the early hours of the morning. The distance from camp to the altitude reached and back was over ten miles: therefore, during the 24 hours I had altogether gone 18 miles (quite a record at such great altitudes). I may here also remark that, since breakfast at 6 o'clock the previous morning, I had taken no food of any kind, thus making an interval of 23 hours between one meal and the next."

But Mr. Landor's capabilities of walking at great altitudes without food of any kind appear to be quite exceptional. For, again, on page 220, he tells us regarding his walk at 16,500 feet elevation.

"With the exception of a handful of oats, this was the first solid meal we had for 48 hours. In those two days we had travelled twenty miles, at 16,500 feet elevation, each of us carrying considerably over sixty pounds."

And, moreover, these strolls over dangerous ground and at great altitudes were not carried out under the most favourable conditions as may easily be gathered from the following.

Page 213. "At last, after endless trouble, threats and promises, Bija Singh, the Pahari, was persuaded to come. But the load was too heavy for him; he would only carry half. To save trouble, I agreed I would carry the other half myself *in addition to my own load*. We put out our hurricane lantern, and at 2 p.m. when the gale was raging at its highest, driving the grit and snow like spikes into our faces; when the wind and cold seemed to penetrate with biting force to the marrow of our bones, a handful of silent men, half frozen and staggering, left the camp to face the blizzard. It was so dark that we could only see a few inches in front of our noses."

Under such conditions it is only to be expected that Mr. Landor had some really narrow escapes in the course of his walks. It is only possible here to quote one of the many that were hair-breadth:—

Page 92.—"The higher I got the harder and more slippery grew the snow. The soles of my shoes having become soaked and frozen made walking very difficult. At 12,000 feet, being about 800 feet above the stream, I had to cross a particularly extensive snowfield, hard, frozen, and rising at a very steep angle. Some of my coolies had gone ahead, the others were

behind. Notwithstanding the track cut by those ahead, it was necessary to re-cut each step with one's own feet, so as to prevent slipping. This was best done by hammering several times into the white sheet with the point of one's shoe, until a cavity was made, deep enough to contain the foot and to support one upright.....I had not the patience for that. I thought I had found a quicker method, and by raising my knee high, I struck the snow with my heel, leaving my foot planted until the other one had, by the same process, cut the next step. It was in giving one of these vigorous thumps that I hit a spot where, under a thin coating of snow, was hard ice. My foot failing in its grip, slipped, and the impulse caused me to lose my balance. I slid down the steep incline at a terrific pace, accompanied in my involuntary tobogganing over ice and snow by the screams of my horror-stricken coolies. I realised that in another moment I should be pitched into the stream, which would have meant being carried under the long tunnel of ice to meet certain death beneath it. In those few seconds I found time to speculate even as to whether those stones by the water's edge would stop me, or whether the impetus must fling me past them into the river. I attempted to get a grip in the snow with my frozen fingers, to stem myself with my heels, but with no success, when I saw ahead of me a large stone rising above the snow. With desperate tension of every nerve and muscle, I knew as I approached it, with the foaming water yonder, that it was my only hope. I consciously straightened my legs for the contact. The bump was tremendous, and seemed to shatter every bone in my body. But it stopped me, and I was saved—only a few feet from the water's edge—miraculously, although fearfully bruised, with no bones broken. My fingers were cut by the ice and bleeding; my clothes were torn to atoms."

As for hardships, the journey from beginning to end was naturally one long series of hardships. The following, however, may be found interesting. At page 218 we read about a night spent at 18,000 feet elevation:—

"At last the morning came! When I tried to raise the blanket in order to sit up,.....it was frozen hard, and as rigid as cardboard, covered over with a foot of snow."

Again, page 212,....."even in my reduced condition I was able to stand an unusual degree of cold. As a matter of fact, the water that had been taken from under the ice immediately froze on my shoulders, with the result that in a second I had icicles hanging on each side of my neck and a shawl of ice over my shoulders"!! (*The points of exclamation are ours.*)

Mr. Henry Savage Landor, however, is not only a pedestrian and mountaineer of the first order, but also, if his own accounts are to be believed, a powerful swimmer and here again quite uninfluenced by temperature. Two of his experiences in frozen water will suffice to establish his reputation,

Page 44.—“Notwithstanding the faith that Chandan Singh and Man Singh had in my swimming, they really thought that their last hour had come when I took each by the hand and asked them to follow me into the stream. Hardly had we gone twelve yards when the inevitable took place. We were all three swept away, and Chandan Singh and Man Singh in their panic clung tight to my arms and dragged me under water. Though I swam my hardest with my legs, we continually came to the surface and then sank again, owing to the dead weight of my helpless mates. But at last, after a desperate struggle, the current washed us on the opposite side, when we found our feet and were soon able to scramble out of the treacherous river. We were some 200 yards down stream from the spot at which we had entered the river, and such was the quantity of muddy water we had swallowed that we all became sick.”

But not content with swimming across a mountain torrent with two coolies clinging to him, Mr Landon must needs go one better :—

“I swam fast to the animal (yâk) and, with no small exertion, pulled him ashore, some two hundred yards further down the stream”

The portions of Thibet traversed by Mr. Landon do not appear to have abounded in game ; and, perhaps, for the sake of the animals this is just as well. They would certainly have stood little chance, if the following adventures are to be taken as fair samples of his prowess :—

Page 67.—“There, there” ! they all screamed at the top of their voices pointing to the summit of the opposite cliff, over four hundred yards distant I put up the Lyman back-sight to 400 yards, took aim and fired. Down came, rolling from rock to rock, the poor wild goat.”

Again page 255.—..... “and we continued our journey along the water-edge of the Davies’ Lake (Rakas-tal) where occasionally hares sprang from under our feet, *several of which I killed with my rifle, using bullet cartridges.*”

In his speech at the distribution of prizes at the Imperial Forest School, Dehra Dûn, in March last, Mr. Ribbentrop is reported on page 171, of the *Indian Forester* to have said. “It has happened, before now, that officers in our service have lost their way in the jungle, and for days have had to exist on forest produce and monkeys, and under such circumstances a strong digestion is by no means to be despised. I have never been able to think of a proper test, or I should have given another prize for the best digestion.” Mr. Landon should indeed compete for this prize. On page 197 he tells us.

“In a corner of Wilson’s tent was a very large quantity of candied sugar—many pounds ; and so famished was I that I quickly devoured the lot.”

But Mr. Landor must look to his laurels, for his servant appears to run him close :—

"Man Singh was found sound asleep, several miles back, lying by the side of the empty butter pot, the contents of which, 5lbs., he had devoured."

It would be interesting to know whether other Himalayan travellers will bear out the following :—

Page 217.—"Experience had taught them that eating cold food at great altitudes is more dangerous than eating no food at all."

On his return from Thibet, Mr. Landor spent a good deal of time round Naini Tal, and officers stationed in those parts of the Himalayas will remember him as a very small, weakly, emaciated and insignificant-looking youth, with a somewhat Mongolian type of countenance. Indeed, he himself, at page 62, tells us that he was soon nicknamed "the monkey, a name of which I have been proud ever since."

Those who have seen him will be able the more to appreciate the great deeds of valour of this modern Baron Munchausen. Three anecdotes must suffice :—

Page 144.—"A matchlock was now being loaded by a soldier, and such was the quantity of gunpowder they placed in the barrel that I made sure whoever fired it would have his head blown off ; so it was with a certain amount of satisfaction that I saw it handed over to the Pombo. That official placed the weapon against my forehead, then a soldier leaning down, applied fire to the fuse and eventually there was a loud report which gave my head a severe shock, and the over-loaded matchlock flew clean out of the Pombo's hand, much to everybody's surprise. I forced myself to laugh....."

Page 208.—"Among them I noticed several of the men who had betrayed me, and as I was told that there was no way of punishing them for treachery, I took justice into my own hands, proceeding with a stout stick to teach them some idea of faithfulness, whereupon the whole village ran up to get the fellows out of my clutches. Encouraged by the Thibetans, the Jhokas made some insulting remarks about Englishmen ; so the fight became general until, ill as I was, and alone against some hundred and fifty (150) men I succeeded in routing them. The thing might justly be doubted had I not been able to take a snap-shot of them as they fled helter-skelter."

Page 24.—"As I saw them take out a flint and steel to light the fuses of their matchlocks, I thought I might as well have my innings first, and before they could guess at my intention, I supplied a violent blow with the muzzle of my rifle to the stomach of the man nearest to me. He collapsed, while I administered another blow to the right temple of another man who held his matchlock between his legs, and was on the point of striking his flint and steel to set the tinder on fire. He, too, staggered

and fell clumsily they retreated, promptly laying down their weapons."

Mr. Landor does not explain why he did not on this occasion also apply his usual nostrum, *viz.* "I made him lick my shoes clean with his tongue" (page 107).

On the whole, *In the Forbidden land*, if taken in the right spirit, is a sufficiently entertaining book of travels, and will supply a goodly number of anecdotes and experiences to relate round the camp fire. On the other hand, if the stories have to be taken *cum grano salis*, perhaps Mr. Landor is not wholly to blame, if we accept his own version as to the method in which his notes were kept, namely:—

"I managed, at considerable risk, to keep a rough record of the journey back, on a small piece of paper that had remained in my pocket when I had been searched by Thibetans. As I did when on the rack, I used to draw my right hand out of its cuff, and with a small piece of bone I had picked up as a pen, and my blood as ink, I drew brief cipher notes and a map of the whole route back.

A. C.

V.-SHIKAR, TRAVEL, &C.

A great stroke of Luck.

A Forest officer having to spend eight months of each year in the jungles, naturally turns to sport as his chief relaxation from work. At the beginning of each camping season most of us no doubt anxiously wonder what good fortune in the shooting line is coming our way. Of course the prospect varies immensely according to the forests one happens to be in charge of at the particular time.

At the beginning of December 1897, I was in one of the easternmost districts of the North-Western Provinces. On starting into camp my wife and I made up our minds that the best bag we could hope for this season might consist of a few good spotted stags, and a possible panther if luck favoured us. It has often been noticed, however, that in shooting as in most other things, the best luck comes when it is least expected. This occasion proved itself no exception to the rule.

My wife and I started from head-quarters on December 3rd, visiting some outlying detached blocks of forest before going to the main forests. The next day, when inspecting the forest, I found numerous tracks of a panther along an unfrequented path. I ordered a young goat to be tied up. Now, panthers in this part seem different to those in any other district that I have been in. They will not as a rule, kill a bait, whether goat or buffalo calf, tied out for them. This must be due, I think, to the fact that wild animals are rendered easy prey to them by the tall grass, 5 to 10 feet high, which characterizes the lower levels of the forest lands in this district. Be this as it may, I had had baits tied up constantly during two seasons but not a panther would touch them, although tracks were frequently observed close to them. The panthers were altogether too clever and evidently suspicious of a tied-out animal. So, when I ordered the goat to be tied out I had little hope that the panther would be induced to take it. I was quite surprised next morning to hear the goat had been killed. Inspecting the spot I found that the panther had eaten all except the head and a small piece of the neck; so I decided to sit up in the evening over a live goat tied at the same place. Having been delayed at work, I was not ready to sit up till about an hour before dark. As I turned the corner, on nearing the spot, I saw the panther, about 200 yards away, sneaking off along the path towards the high grass to the south of the forest. He saw me and turned off into the jungle. My men, having quickly tied up the *machan*, waited till I was settled, then tethered the live goat at the further edge of the line. They departed, talking loudly, to let the panther know they had gone.

The line, near the edge of which I was posted, ran nearly north and south through the centre of the forest. It was cleared of trees for a width of 15 feet and in the middle an inspection path had been cleaned six feet wide. On either side the forest was fairly dense consisting of *sdl* (*shorea robusta*) poles with a good deal of undergrowth. About half a mile to the south the *sdl* forest abruptly terminated in heavy grass, some 8 feet high, in the direction of which I had seen the panther retreating. My *machan* was on the eastern side of the line, a few yards inside the forest, and the goat was tethered on the western edge. The goat called vigorously to the retreating men, imagining it had been left by itself, since it had not been allowed to see me climb up into the *machan*. This soon attracted the panther; for, before half an hour had elapsed I got a fleeting glimpse of him in among the undergrowth on the further side, i. e., west, of the goat. He then evidently crouched for some time, taking in the surroundings. But the goat did not seem aware of his proximity. Suddenly, having made up his mind that all was safe, the panther began playing with him, making repeated feints, as if he were

going to seize him. The goat, a small male about 18 months old, although no doubt very frightened, was most plucky, and keeping his head towards the panther, butted the air, and snorting, stamped with his fore feet. It was now dusk, but a bright moon was shining. I could not see the panther at all, as all this performance was going on under the dense undergrowth, but could hear his pretended rushes and could see the goat's antics well. After about a quarter of an hour of this by-play the panther dashed off towards the west, further into the jungle, away from the goat. The latter seemed very pleased but continued to look in the direction the panther had taken, hardly daring, I suppose, to believe that the panther had really gone. I was beginning myself to think that he had seen me and hastily retreated, since for the next quarter of an hour hardly a sound was heard in the still moonlight. The goat continued looking steadfastly in the direction the panther had gone quite unaware that the latter had only departed to make a detour, preferring to stalk him from behind than to face his determined butting. I myself was not aware that this was the case, until I suddenly saw him sneak out of the forest on my side of the line, worming himself along with his belly touching the ground. As he entered the band of bright moonlight of the line, he was only some 20 or 25 feet away from me. I hastily took a snap-shot with my Express and had the satisfaction of seeing him roll over, without a sound, in the middle of the six-foot path.

The surprise of the goat must have been great. He was indeed delighted, when I holloaed for the elephant, to find that a man was near him after all. When the elephant was approaching I kept my eye on the panther, but not seeing even a twitch in his tail I concluded he was dead. I got down and, having thrown two or three clods at him without effect, approached carefully towards his tail end to see where the bullet had hit him. I found it had broken the backbone, so knew from the position of the *machan* that it must have reached his heart, and lungs as well, and that there was no fear of his not being really dead. My orderly, who came with the elephant, and I held the brute up while the *mahaut* tied him on to the pad of the elephant. I did not like the job however, as the panther felt so warm and life-like. He was a small male, just over six feet long, with lovely fur.

Thus, after two days only of camp, the possible bagging of a panther became a *fait accompli*. My wife and I agreed that this ought to be a good omen for the success of the season. So it turned out.

It would be difficult to imagine our excitement when, a few days after, we heard that a rhinoceros had appeared in the main block of forest, at least, said the report, the tracks of one had been seen. So far as we could ascertain such a beast had not, within the memory of the oldest inhabitants, been heard of in

this part before. We therefore hardly dared to hope that such an improbability was true and we thought there must have been some mistake. I eagerly sent for all my books from which I could gather any information about this curious genus and their habits, and did not forget Rowland Ward's useful little "Sportsmans' Handbook" which shows the vital spots of the larger mammalia. Many were the conjectures we made as to whether this stranger could really be a Great Indian Rhinoceros (*R. unicornis*) or the smaller one (*R. sondaicus*). From Kinloch's "Large Game shooting," I found it was quite feasible to bag the beast, should he really be there, by quietly following up his tracks, on a single elephant, which was all I had at my disposal.

For several days after I received the news I was engaged in my work, but we decided to devote the coming holidays to the pursuit of this prize and settled that a forest rest-house in the heart of the main reserve should be our head-quarters during the quest. We arrived there on the 23rd December and a few miles off I was shown tracks which, though several days old, at once cleared my mind of all doubt and proved that a rhinoceros had really been there.

The reserve in question, situated only a few miles south of the Nepal boundary, is a large block of some 69 square miles in extent, consisting chiefly of compact forests of *sal* divided up by large stretches of tall grass intersected by rivers. The grass lands correspond with the area annually under water for the greater part of the four months of the rainy season. After that most of the water drains away leaving large expanses of water and marsh on the lower levels. It seemed an ideal abode for a rhinoceros and, knowing that he had been there, I felt sure he would not leave such a place of his own accord.

I had sent, beforehand, for the four best trackers to be obtained in the neighbourhood. They were *Bhurs*, a wild aboriginal tribe, who are more at home in the jungles than elsewhere, and these for several days had been roaming in pairs to try and find fresh tracks for me. They came to me on the evening of the 23rd and said they could not find any. Their task was not a very difficult one, as the whole reserve is divided up by cleared fire-lines, 50 or 100 feet wide, and by roads, some of which the animal was bound to cross; but as I was no more successful myself that day in discovering recent tracks I could not upbraid them. However, I found out they had conceived a mortal dread of the strange beast which, they declared, when it saw a man, mesmerized him and then slowly walked up to him and licked him to death with its huge tongue. Later on a forest guard came to report he had found fresh tracks in his beat. I decided to go there early next morning and gave orders to the *mahaut* to have the elephant ready. The latter, named "Gunga Pershad," is the property of the Forest Department. He is

a fine young male elephant, some 30 years old, perfectly quiet to shoot from, and as far as my experience goes, fears nothing though up to date he has not encountered a charging tiger. The *mahaut* listened to the order with a sad face and departed. Soon after, however, he re-appeared and said "Sabib ! no elephant will go within a mile of a rhinoceros." "Gunga Pershad will," said I. He answered:—"If you insist on taking him he will certainly get killed by the rhinoceros, for they are deadly enemies." I said:—"Very well, if he gets killed I will buy another one." Seeing that I was determined to go, he said no more but later on I overheard him saying to another servant:—"Does not everyone know of the Rajah who had twenty elephants all killed by one rhino?" This common belief among natives is alluded to by Kinloch and Blandford.

Now came the crux. What weapon should I shoot with ? I had no heavy battery and indeed only two rifles with me ; one a double-barrelled hammerless ejector No. 2 Express by Westley Richards, the other a Martini-Henri sporting carbine, taking also the M. H. R. cartridge. I remember a well-known sportsman of the Central Provinces telling me in 1890 that, if he had to shoot big game like elephant and buffalo, and if he were only allowed one rifle, he would choose a M. H. R.* This statement impressed me greatly at the time; and, profiting by it, I have been much more successful with a single M. H. R. against buffalo and bison than with heavy, double-barrelled 8, 10 or 12 bores, all of which I have tried. With the Martini-Henri, however, one soon learnt that it was no use attempting to shoot such large animals unless one had a clear shot at a vital spot. I decided to take my first shot with it; for, although my Express was a grand rifle and Westley Richards had made me some special hardened solid bullets for big animals, I had not so far tested them.

On the morning of the 24th I started on the elephant, taking the trackers with me. Having reached the spot where the forest guard had seen the tracks, we found fresh ones of that morning and our search commenced. The tracks led into tall *ratwa* grass, with a few groups of trees on the higher ground and shallow ponds on the lower. We came upon tracks in all directions which rendered the fresh ones undistinguishable. After searching about for a long time we found a place where the rhino had been lying down that morning, and fresh droppings close by, but I think the noise made by the elephant walking through the water must have alarmed him; for, though we continued searching all day we could not find him.

Next day, Christmas day, I did not go out but sent the trackers to see if there were any new tracks. They reported in

* Possibly he now believes in a .303. ? Personally, I have not had the opportunity of trying one of these small bores yet.

the evening that there were, so on the 26th morning I again started. When I arrived at the spot where the tracks were found I quietly posted three of the trackers, in different parts, in trees, who might be able to give me information in case I disturbed the rhino. The other *Bhur* I took with me on the elephant. This time, knowing the ground, I made the elephant go quietly round the water to the place where we had found he had lain down two days before, but the rhino was not there.

There was a shady clump of trees, with short grass under them, about 100 yards on, which looked a likely place, so I went on, and when half way through, I suddenly saw the legs of the rhino about 60 yards to the right. Having backed the elephant a couple of paces I saw the whole beast standing, broadside on, under the trees and obtained a steady shot with the Martini-Henri at the centre of the front right shield. I felt sure that the bullet was well placed, but the rhino, having only flinched to the shot, began going away at a slow pace. I was then most anxious lest the beast might get out of sight and re-cross into Nepal, whither I could not follow; so I ordered the *mahaut* to urge on the elephant in pursuit and I put five solid bullets out of the Express into him before he fell. On cutting him up, however, I found that the Martini bullet had gone through both lungs and heart; so the remaining bullets were unnecessary. He fell on his left side, and not in a sitting posture, as it is said they generally do.

He was indeed a grand beast and I was in luck to have secured such a prize. He turned out to be a fine specimen of *R. unicornis*; but his horn, which was much worn and knocked about, measured only $7\frac{1}{2}$ inches. Afterwards I found that a new horn had begun to be developed under the old one, and doubtless in a short time the latter would have been cast off.

Rhinoceros are, I am told, fairly plentiful in Nepal, in the *Dun* to the north of the lower range of hills, but they are strictly preserved as Royal game. Only the Maharaja shoots them; no one else apparently is allowed to pursue them. This one, I heard subsequently, was washed down the river in a flood in September, but scrambled out near the Nepal boundary. He remained just inside Nepal in the grass-lands there till the end of November, when the people began to cut the grass for thatching their huts. Then, being disturbed by them, he found his way one night across 12 miles of open cultivated country to the Government forest where he was shot.

The news of his death spread rapidly, and next day, although the nearest villages were six miles off, hundreds of natives came to see him and begged for pieces of meat; and failing that, of bone or skin. For weeks afterwards the people continued to come to my camp to see the skin and trophies, and altogether, while it was drying, I think not less than 5,000 people must have come, some of them from distances of 25 and 30 miles. Kinloch says that the meat is excellent and so it certainly proved.

The measurements of this rhinoceros were as follows:—

	Feet	Inches.
Length from nose to tip of tail ...	12	11
Do. of body ...	10	9
Do. of tail ...	2	2
Height at shoulder ...	5	8½
Girth of body behind shoulder ...	8	10
Do. of stomach ...	11	4½
Do. of neck ...	5	2
Do. of foreleg above knee ...	1	10
Do. of head ...	5	3½
Breadth of forehead ...	1	2
Length from toe to heel (fore-foot) ...	0	11
Breadth of fore-foot ...	0	8½
Circumference of fore-foot ...	2	6½
Length of horn ...	0	7½

F. Z. S.

VI.—EXTRACTS, NOTES AND QUERIES.

Transformation of Alburnum into Duramen in the oak. *

M. E. Mer has studied the mode of formation of the duramen out of alburnum in *Quercus Robur* and *Q. pedunculata*. The duramen is characterised by a resorption of the starch in the ligneous and radial cells; by the appearance in these elements of a large quantity of tannin; by the production of thyllæ in the large vessels; and by the impregnation of tannin into the walls of all the elements, especially those of the vascular bundles. It was determined by observation and experiment that the entire disappearance of starch from the cortical region is not due to migration but to resorption, it being replaced by fresh starch which is being constantly formed in the leaves. The appearance of tannin coincides with the disappearance of the starch. The formation of thyllæ in the duramen is due to a renewal of cellular activity produced by hypernutrition. The main function of the alburnum is, therefore, to furnish a supply of nutriment for the production of the "perfect wood" (duramen).

* Journal Royal Microscopical Society. Original paper in Ann. Sci^{ts} Nat (Bot),

Bursting of the mechanical ring in climbing plants.*

From the examination of a number of trees and shrubs belonging to different natural orders, Herr E. Schwabach states that a perfectly closed stereome ring in the young stem occurs only in climbing plants. As the girth increases, this mechanical ring bursts, and at the same time the adjacent parenchyme cells, rich in protoplasm, force themselves, by their turgor, into the vacancies and distend them. This takes place so quickly that it is impossible to find such a cavity, which is not filled up by meristematic tissue. The meristematic cells thus introduced thicken their walls and become transformed into stone-cells with extraordinary rapidity and thus increase the mechanical functions of the ring. The bursting usually takes place in the radial prolongation of the medullary rays, especially where the stereome ring offers the least resistance. The penetration of the parenchymatous cells, which adjoin the stereome ring, takes place on both the outer and inner sides of the ring.

Classification of Fruits. †

Signor L. Nicotra proposes several modifications in the terms at present applied to different kinds of fruit. He proposes the term *holocarp* (*olocarpio*) for an entire fruit resulting from a number of carpels, the product of each carpel being a "mericarp." The holocarp may be an *apocarp* or a *syncarp*, depending on the degree of concrescence of the carpels; but these two forms pass insensibly one into the other. According to the arrangement of the carpels into a spiral or in a whorl, a holocarp is a *helicocarp* or an *actinocarp*, and furthermore according to the position of the placentæ, it is *pleurospemic* or *antispermic*. The caryopsis differs but very slightly from the achene. The author regards the follicle as probably a primordial carpological type, from which are derived, in various directions, the legume, the single-seeded indehiscent achene, the siliqua and the various forms of capsule.

Indigo fermentation. ‡

According to Professor H. Molisch, the transformation of indican into indigo blue in *Indigofera* is not due, in the first place, to the action of bacteria; whether within or

* Journal Royal Microscopical Society. Original paper in *Bot Centralblatt*

† Journal Royal Microscopical Society. Original paper in *Bull. Soc. Bot. Ital.*

‡ Journal Royal Microscopical Society, S. B. K. Akad. Wiss. Oester. Bot. Zeitschrift.

without the dead cell, oxygen is indispensable to the process. It is accompanied by a number of different bacteria, and not by a single species, as previously supposed, and mould-fungi are also present. In some cases (seedlings), indican is formed only in the light; in other cases both in the light and in the dark, but always more abundantly in the light. The following species, in addition to Indigofera, are named as Indigo plants:—*Echites religiosa*, *Wrightia antidysenterica*, *Crotalaria Cunninghamii*, *C. turgida* *C. incana*.

Vaccinating properties of mushroom-juice against venom. *

M. C. Phisalix has found that mushrooms contain substances having vaccinating properties against serpent venom. Some 200 experiments made with poisonous and edible mushrooms show that their juice, which contains these bodies in solution, confers immunity against venom. Injection (subcutaneous, intraperitoneal and intravenous) of small doses of the juice of *Agaricus arvensis* produces local and general reaction; of large doses, rapid death with clotting of the blood. The toxic effects of the juice, even when heated for 20 minutes to 120°, are not completely removed.

When a guinea-pig has been injected with 5 to 20 ccm. of the juice, after a few days it will resist a dose of venom fatal in 5 or 6 hours to the control-animals. This immunity may be augmented to a certain degree by increasing the number of inoculations. The immunity thus acquired lasts from 15 days to one month. The raw juice often produces necrotic effects; these are lessened by using filtered juice, and are avoided by boiling it for a few minutes. This, so far from impairing the vaccinating property, rather seems to favour it.

A "William Prothero Thomas" prize at the Imperial Forest School.

To perpetuate the memory of the late Mr. Thomas, two Extra Assistant Conservators in the Central Provinces (Mr. Chander Kumar Chatterji and Mr Narain Pershad Bajpai) have generously endowed with Rs. 500, a prize to be annually awarded to the best passed student of the Imperial Forest School in Practical Forestry.

This liberal contribution signalizes the high esteem in which Thomas was held by his brother-officers of the Provincial Service.

* Journ. Roy. Microscopical Society. See Comptes. Rendus, CXXVII.

VIII. TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

May 3rd, 1899.

EAST INDIAN TEAK.—There is no change to report in the prospects for this wood, for which the demand still keeps ahead of the supply, and floating cargoes continue to be absorbed at the highest current rates of the hour. In London, the month's deliveries amount to 1,274 loads, against 1,330 loads in April, 1898, making the deliveries for the first four months of this year 6,986 loads as compared with 7,475 loads for the same period of 1898. The local demand has been a little dull during the month, and prices are hardly as elastic as they were in March.

ROSEWOOD.—**EAST INDIA.**—There is a good demand and fair parcels sell well.

SATINWOOD.—**EAST INDIA.**—Is quiet and there is sufficient supply.

EBONY.—**EAST INDIA.**—Small lots of really good logs would realise fair prices.

PRICE CURRENT.

Indian Teak	per load	...	£11 10s.	to £16 10s.
Rosewood	„ ton	...	£9	to £11
Satinwood	„ sft.	...	5d.	to 12d.
Ebony	„ ton	...	£6	to £ 8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST MAY, 1899.

TEAK.—The landings in the London Docks during April consisted of 152 loads of logs and 302 loads of planks, as against deliveries into consumption of 981 loads of logs and 419 loads of planks.

The dock stocks analyse as follows :—

8,581	loads of logs,	as against	11,885	loads at the same date last year.
2,300	„ planks	„	2,033	„ „ „
28	„ blocks	„	14	„ „ „
<hr/> 9,867 loads		„	<hr/> 14,832 loads.	

Teak values naturally continue to harden in face of reduced stocks and the consumption continuing to heavily exceed the importation, but the market on this side is still below the pretensions of the Indian shippers both for logs and planks, and merchants and dealers here consequently find the position very difficult in respect to forward purchasing.

Business during April was good all round, and perceptibly brisker in many branches of the timber trade than during the first quarter of the year.

MARKET RATES OF PRODUCE.

Tropical Agriculturist.

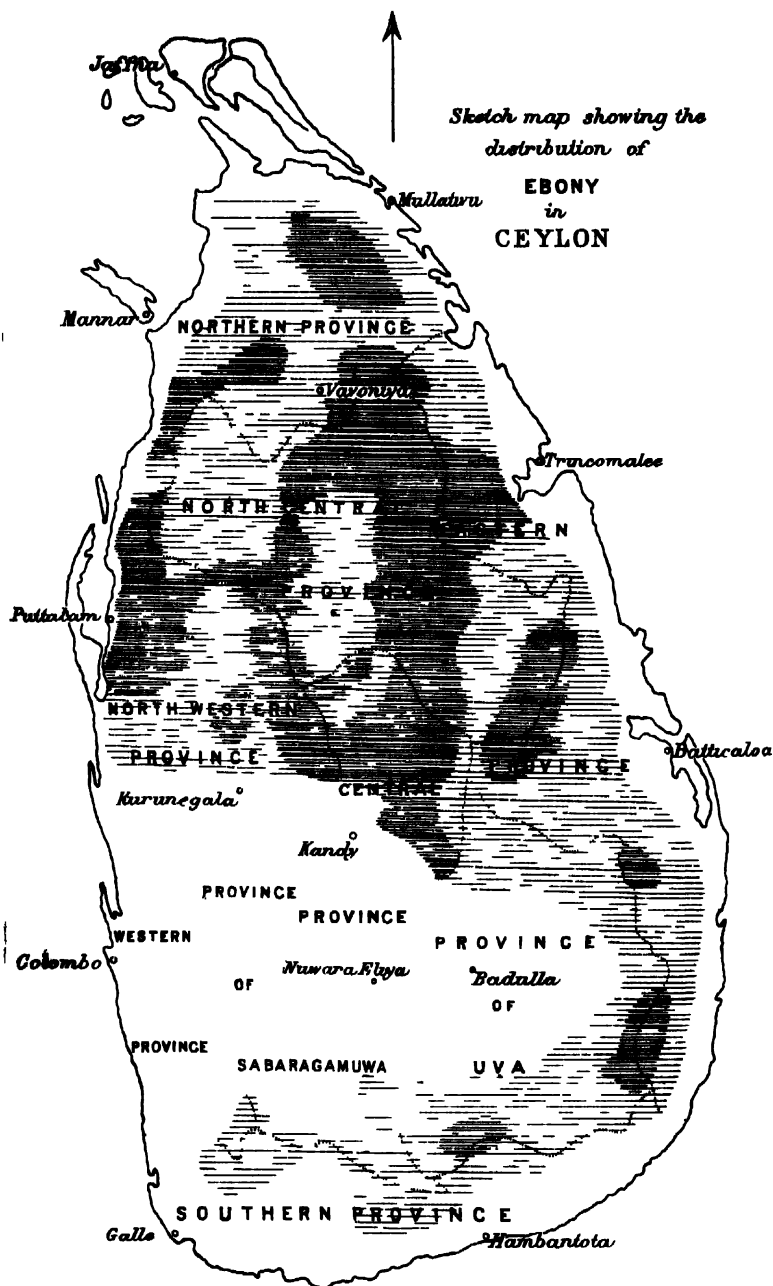
May 1st, 1899.

Cardamoms		per lb.	3s. 9d.	to	4s. 5d.
Oroton Seeds		" cwt.	55s.	to	70s
Cutch		" "	9s. 3d.	to	32s. 6d
Gum Arabic,	Madras	" "	27s. 6d.	to	35s.
"	Kino	" "	7s.		
India rubber,	Assam	" lb.	2s. 9d.	to	3s. 3d
"	Burma	" "	2s. 9d.	to	3s.
Myrabolams,	Madras	" cwt.	6s.	to	6s. 6d
"	Bombay	" "	4s. 9d.	to	10s.
"	Jubbulpur	" "	4s. 9d.	to	9s. 6d
"	Bengal	" "	4s. 6d.	to	7s.
Nux Vomica		" "	4s.	to	5s. 6d
Oil, Lemon	grass	" lb.	2½d.	to	2½d.
Sandalwood,	Logs	" ton	£30	to	£50.
"	Chips	" "	£1	to	£8.
Sapanwood		" "	£4	to	£5.
Seed lac		" cwt.	55s.	to	69s.
Tamarind, Calcutta		" "	10s.		

CORRIGENDA.

Indian Forester, June 1899.

- Page 233, line 1, *for* "fifty-seven thousand" *read* "five
hundred and seventy thousand"
„ 252, line 6 *for* "Tharramaddy" *read* "Tharrawaddy."



N.B The best forests are indicated by denser shading

THE INDIAN FORESTER.

Vol. XXV.]

July, 1899.

[No. 7.

Ceylon Ebony.

DIOSPYROS EBENUM—Koenig.

The name Ceylon Ebony for *D. Ebenum* is not absolutely correct, for this species is found in Southern India, nor is it only Ceylon *Diospyros* which has a black heart-wood there being others such as *D. ovalifolia*, *D. crumenata*, *D. Melanoeylon* and *D. oocarpa* which furnish a certain amount of ebony. It is even not certain whether the species will not have to be subdivided into two on account of the varied arrangement of the fruit, whether solitary or in clusters in the axils of the leaves. It is however convenient for me to use this name as it is used in the timber trade, and also because my acquaintance with it is limited to Ceylon.

Habit.—Without going into botanical details it may be said that this is a large evergreen tree, attaining a girth of up to 14 feet. It has a roughish bark of a dark colour which, in exposed situations, has a greyish tinge. The leaves are also dark and appear as if sprinkled over with fine charcoal dust. Several other species of *Diospyros* possess very similar characteristics and it requires a certain amount of experience to distinguish the species, especially saplings and young trees.

Distribution.—Ebony has almost the same range of distribution as satinwood as the annexed sketch map will show, but it is found more abundantly in the intermediate zone and in the south of the island it penetrates even into the moist zone. But it is most abundant in the dry zone and the richer forests are all in the Northern half of the island, especially in the Eastern portion of the North-Central Province. It is also well represented in the Northern and North-Western Provinces.

Soil.—The best ebony is found on rocky well-drained soil. It is at times found on soil containing a larger proportion of clay than satinwood can endure but, generally speaking, it is found like satinwood on sandy loam with a good subsoil drainage. It is frequently found near watercourses, which are dry during a part of the year, but in swampy soil never. It differs in this respect from *Diospyros Embryopteris* which is frequently found near rivers, pools or tanks.

Companion species.—As I have stated before, satinwood is frequently a companion of ebony, as also *Mimusops hexandra*, *Nephelium longana*, *Gleniea zeylanica*, *Diospyros ovalifolia*, *D. crumenata*, *D. oocarpa*, *D. montana*, *Vitex altissima*, *Albizia odoratissima*, *Berrya Ammonilla* on the moister soils, and many others. I have never seen ebony growing pure and the proportion of this species to the many others is always small. In the richer forests there may be 10 to 15 trees per acre or, taking the saplings into account, perhaps 50 trees, but this percentage is high. I have only heard of one instance, in the Mannar District, where there were 40 trees (exclusive of saplings) per acre. In an enumeration survey made recently over 50 acres in a fairly rich ebony forest in the North-Western Province, 26 trees over 6 feet in girth, 65 from 4 feet 6 inches to 6 feet and 120 trees between 3 feet and 4 feet 6 inches were counted. This gives a total of 4 trees over 3 feet in girth per acre. In average ebony forest, enumeration surveys both linear and by sample area made in the Northern, Eastern and North-Western Provinces, have shown that there are generally not more than 3 to 4 trees over 9 inches in girth per acre. This is, no doubt, partly due to the extensive and wasteful fellings which were carried on for many years over the Ceylon forests, and partly to the absence of improvement fellings required for furthering the growth of the young trees and saplings.

Sylvicultural requirements.—Unlike satinwood, ebony does not require much light for its seedlings. As a rule, it will suffice to cut the underwood and to girdle here and there a low-crowned tree. But after the seedlings have established themselves it is necessary to remove the cover which is directly overhead, not more. When the trees reach their maximum height, it is time to give more room to their crowns, but until then it is best not to let in too much light. It is difficult to see how the seed gets distributed over the soil of the forest, except in hilly ground, where it rolls down the slopes, or near streams or foot paths acting as such during wet weather, and yet trees are found, as often as not, at the top of a slope although the seed is neither light nor apparently palatable to birds or mammals although it becomes a prey to weevils, which would be rather a factor in the destruction than in the distribution of the seed. The seed usually ripens before the North-Eastern monsoon, but the good seed-years are not regular

nor is the seeding equally good all over the forests at the same time. Observations taken in the forests since 1890 have not recorded a single universally good year, but the years 1891 and 1896 appear to have been the best while in 1892-93 and 1897 the seeding was fair. The good seed-years do not appear to come in any regular rotation but are dependent chiefly on rainfall at the right time. Occasionally, ebony seeds twice in the year. (*Ceylon Forester*).

Rate of growth.—There are, unfortunately, not yet sufficiently reliable data to show the rate at which this tree grows. Several sample plots have been started but they contain so few trees, sometimes not even all girth-classes being represented, that it is not possible to take the measurements as absolutely reliable. As a rule, after passing 3 ft. in girth, ebony is very slow growing, more so than satinwood. From the data which I have been able to collect the rate of growth in the forest appears to be about the following, but, as I say, the figures are very liable to correction. The present measurements seem to show that a tree reaches a girth of 18 inches at the age of 25 years, 36 inches at 75 years, 54 inches at 135 years and 6 feet in girth at the age of 200 years. On deep soil these figures are probably below the mark and the trees grow faster.

The timber.—The proportion of heart-wood to sap-wood varies a good deal. It is commonly considered that timber grown on deep soil contains a smaller proportion of heart-wood than trees growing on rocky slopes. My own experience coincides with this theory, not only as regards *D. Flenum* but also as regards *D. Melanoxylon*. As regards the latter, I remember that small trees on the stony slopes of the Ganges division gave a far larger supply of blackwood than comparatively large trees growing on alluvial soil in the western part of the Saharanpur division. Recently, 15 trees of Ceylon ebony, varying in girth from 6 ft. to 12 ft. were measured carefully. The gross volume of these trees amounted to 1,208 cft. while the volume of blackwood was 282 cft. or less than one quarter of the volume, the proportion of heart-wood in the individual logs varying from 0.14 to 0.35. This was in good soil and measurements have yet to be made to find out the proportion of blackwood on rocky soil. As a rule, I do not think that the thickness of the sap-wood cylinder is much less than 3 inches. The largest log of ebony, which I have seen, measured 7 feet in girth after the sap-wood had been removed. Together with the sap-wood it must have been very large; for, of the 12 ft. logs mentioned above, one gave a measurement of blackwood of 5 ft. 3 in. while another measured only 4 ft. in girth after peeling. The sap-wood is very light coloured and soft. It is peeled off by means of heavy felling axes. Circular incisions are made round the log at distances of about 2 feet apart and the portions between trimmed off. It is possible to get the wood naturally peeled by leaving the logs in the forest for some years, but

timber merchants do not like these logs and consider them to be dead wood. They, therefore, fetch lower prices. The heart-wood is not necessarily black throughout. On the contrary, streaks of white or pale brown colour are not infrequent. Some forests of the island produce blacker wood than others. For example, ebony from the western side of the island is usually less streaky than that found on the east. Generally speaking, the market favours the black ebony, if it is of as good dimensions as the streaky logs, the China market especially requires the wood quite black. For cabinet work, however, especially for ornamental beading and framing, the streaky wood is in request as it is used as a substitute for calamander. As regards the comparative value of the different ebonies in India and Ceylon, it is somewhat difficult to make a comparison. *D. Ebenum* usually gives logs of larger dimensions and is on that account more valuable. In the local market, Indian ebony does not fetch as high a price as Ceylon ebony. Some years ago a local merchant imported a parcel of logs from India. The logs were of fair girth and very black, and yet they only fetched poor prices. The explanation given was, that Ceylon ebony takes a much better polish than that from India. I was not able to ascertain whether the logs referred to were *D. Melanoxylon*. If so, they were remarkably fine. Of the different ebonies which I am acquainted with, *D. Ebenum* seems to be the most close-grained. Its surface, when polished, feels more greasy to the touch than others and this, no doubt, accounts for the higher degree of polish which it can take. The weight, according to Gamble, varies from 61 to 81 lbs. per cubic foot. I have weighed carefully six well air-dried specimens from different parts of the island and found their weights to have varied from 90 lbs. to 77.7 lbs. per cft, the average being 78.9 lbs. per cft.

Market.—The prices realized for ebony in Ceylon range up usually to Rs. 180 or Rs. 185 per ton (weighed) for good lots. I have once known the price to go up to Rs. 210 per ton, but it rarely exceeds Rs. 185, and I have never known the price of first class ebony go below Rs. 150 to 160 per ton. The price not only depends on the state of the market in Europe and China but on freight available. If freight is scarce or high the price naturally goes down. I may add that it is by no means an easy matter to obtain freight for timber, especially when large consignments of tea are being sent home.

It may be of interest to Indian readers to know how the sales are conducted. All ebony, excepting branch-wood, top pieces and dead wood remaining from former fellings which are sold in the forest or at minor depôts, is sent to Colombo, where it is sorted at the Central Timber Depôt into lots, as homogeneous as possible.

[Extract from the "Ceylon Government Gazette" of September 30, 1898.]

Gale of Ebony.

AN auction sale of the under-mentioned ebony will be held at the Central Timber Depot, Kew road, Slave Island, on Monday, ^{cases or boxes.} November 21st, 1898, at 2 p. m. Total quantity offered for sale : 365 logs—187 tons 3 cwt. 1 qr. 3 lb. :—

Lot.	No. of Logs each Lot.	Total Weight.	Average Weight.	Average.		District in which Ebony was cut.	Soundness of Logs.	Blackness of Wood.	Whether the Logs are from Dead or Green Trees.	Weight of Log in each Lot.		Length.		No. of Logs in each Lot over 15 ft. in Length.	Price realized per ton. (weighted.)
				Length.	Girth.					T. C. Q. L.	T. C. Q. L.	Maximum.	Minimum.		
1	15	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 3 0 0	Ft. in.	Ft. in.	Matsile	Inferior	Black	Green	T. C. Q. L.	T. C. Q. L.	Ft. in.	Ft. in.	—	Rs. 65
2	25	T. C. Q. L. 0 9 8 2	T. C. Q. L. 0 2 1 13	14	0	do.	do.	do.	do.	0 16 2 10	0 4 0 4	17	6	—	30
3	25	T. C. Q. L. 0 9 8 2	T. C. Q. L. 0 2 1 13	14	0	do.	Sound	do.	do.	0 16 2 10	0 4 0 4	17	6	5	163.
4	4	T. C. Q. L. 1 13 0 0	T. C. Q. L. 0 8 0 12	13	0	Kurungela	Inferior	do.	do.	0 10 0 20	0 3 2 16	23	0	1	195
5	12	T. C. Q. L. 3 13 0 0	T. C. Q. L. 0 8 0 12	13	0	do.	Inferior	do.	do.	0 10 0 20	0 3 2 16	23	0	—	90
6	2	T. C. Q. L. 1 12 1 0	T. C. Q. L. 0 16 2 17	16	6	do.	do	do.	do.	0 10 0 20	0 3 2 16	23	0	—	196
7	3	T. C. Q. L. 1 12 1 0	T. C. Q. L. 0 16 2 17	16	6	do.	do	do.	do.	0 10 0 20	0 3 2 16	23	0	—	196
8	3	T. C. Q. L. 1 12 1 0	T. C. Q. L. 0 16 2 17	16	6	do.	do	do.	do.	0 10 0 20	0 3 2 16	23	0	—	196
9	3	T. C. Q. L. 1 12 1 0	T. C. Q. L. 0 16 2 17	16	6	do.	do	do.	do.	0 10 0 20	0 3 2 16	23	0	—	196
10	11	T. C. Q. L. 1 0 8 5	T. C. Q. L. 0 8 3 17	20	0	Trincomalee	Inferior	do.	do.	1 7 3 30	0 13 8 20	18	6	3	135
11	5	T. C. Q. L. 1 0 8 5	T. C. Q. L. 0 8 3 17	20	0	do.	Sound	do.	do.	1 7 3 30	0 13 8 20	18	6	2	135
12	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Inferior	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
13	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
14	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
15	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
16	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
17	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
18	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
19	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
20	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
21	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
22	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
23	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
24	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
25	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
26	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
27	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
28	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
29	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
30	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
31	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
32	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
33	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
34	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
35	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
36	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
37	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
38	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
39	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
40	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
41	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
42	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
43	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
44	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
45	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
46	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
47	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
48	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
49	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
50	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
51	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
52	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
53	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
54	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
55	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
56	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
57	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
58	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
59	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
60	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
61	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
62	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
63	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
64	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
65	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
66	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
67	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
68	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
69	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
70	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
71	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
72	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
73	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
74	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
75	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
76	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
77	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
78	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
79	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
80	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
81	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.	Sound	do.	do.	0 16 0 28	0 6 3 8	24	6	10	163
82	1	T. C. Q. L. 2 10 1 6	T. C. Q. L. 0 8 1 10	—	—	do.</									

The timber may be inspected on application made to the Superintendent, Central Timber Depot, who will give any further information that may be required.

A. F. BASOM,
Conservator of Forests.

Office of the Conservator of Forests,
Colombo, September 26, 1892.

A. P. BROUS,
Conservator of Forests.

After the lots have been weighed and measured a notice of auction, as shown in the annexed statement (not including the last column showing prices realized at the sale), is published in the Government Gazette and in the local papers. The Government Printer furnishes the Superintendent of the Central Dépôt with a number of copies of the notice published in the Gazette, which the latter sends to the different firms in Colombo and elsewhere. The lists give all the particulars required by the firms and they are sent to the houses in Europe or China for which they wish to purchase. As the notice is published some two months before the auction, there is ample time for all the firms to make proper arrangements. The specimen given here gives the details about the last auction held in Colombo, and in the last column, the prices obtained per ton are indicated. The auction was a very successful one as the average price obtained was Rs. 150·18 per ton.

The chief markets are in England, Germany and China. As regards the last-named country the demand fell off after 1889, during which year little ebony was sold and the trade received a further shock during the China-Japan war, but it is now showing signs of reviving.

(Outturn.)—The number of tons of ebony sold from 1889 to 1898 (both inclusive) amounts to 2,999·72 or on an average 299·97 tons per annum. This appears to be a small outturn, but the reason for it will become apparent when I state that the average exports from 1862 to 1881 alone, to say nothing of the local sales, amounted to 22,522·5 tons or on an average 1,126 tons per annum and that in 1881 as many as 2,600 tons were exported. This appears to have been the climax and in 1888, the year before the Forest Department was organized, the exports fell to 617 tons. This may have been partly due to Mr. Vincent's spirited report on the subject, but more probably to the forests near to the export centres becoming exhausted. But the damage done to the forests was by no means confined to the amount of ebony exported. First of all the fellings were made without any consideration for sylvicultural requirements. Then, there is a very fair local trade in ebony, which is not taken into consideration in the table of exports. A lot of trees were also wasted, felled and found hollow and too far to be carted at a highly remunerative rate and they were left in the forests to rot. By no means a small proportion of the ebony sold between 1889 and 1898 consisted of logs and top pieces from former fellings and of dead trees.

Perhaps the greatest harm done to the ebony forests was caused by tapping the trees. As I have said before, the amount of heart-wood varies greatly. The fellers did not want to waste their time on trees giving a small yield of blackwood. They therefore went from tree to tree, not even sparing comparatively small ones, and with their axes cut deep notches on

different sides so as to find out how deep the heart-wood lay. In some forests, especially in those within fairly easy reach of the sea, there is hardly a tree to be found which is not thus mutilated. The marks thus made almost invariably lead to unsoundness and it is pitiable to find in forests, which have been worked many years back, hardly any but hollow trees. It is, therefore, apparent that the forests must now be worked with great leniency and, in consequence, the sales have hitherto been limited to from 8 to 400 tons per annum. In future the forests will be only worked on a possibility by area which will prevent overworking.

Uses of the wood.—In China, ebony is used chiefly for the manufacture of chopsticks and for pipes, also for carved stands for supporting vases, images, &c. In Europe it is used for turnery, cabinet work, and specially for the keys of pianos, for rulers, backs of brushes, &c. For furniture, ebony is largely used in Ceylon but it is too heavy, excepting for pieces which are either small, or such as do not require to be moved frequently. It is more suitable for in-laying, and streaky wood is used for edging panels of lighter coloured woods. Mr. H. P. C. Armitage in the "Ceylon Forester" says "that ebony shavings mixed with *Terminalia chebula*, alum and other substances boiled in water are used as a remedy for toothache, and that ebony dust and sulphur are put in dog's food as a remedy for mange."

A. F. BROWN.

The supply of Railway sleepers.

The *Indian and Eastern Engineer* of January puts forward the axiom that "it would help materially to cheapen both railway construction and maintenance if the annual yield of timber from the Himalayas could be enhanced," and it points out that the deodar sleeper is the best and also cheapest. We may, therefore, assume that the writer has in view the yield of *deodar* timber.

It is pertinently said that the *Articles* which have appeared in the *Indian Forester* give no answer to the questions whether the Himalayan forests do, or do not, contain sufficient timber to give the desired yield in sleepers; and if they do not, whether they could be further developed by careful arboriculture.

To these questions we propose to give such elaboration as may lead to the definite answers which our contemporary seeks.

In the first place the deodar, as explained by Brandis in the *Forest Flora of North-West and Central India*, "has a limited range of distribution. It is indigenous on the mountains of Afghanistan and North Baluchistan, and in the North-West Himalayas.

"No indigenous forests of it are known east of 80°, or west of 66° long."; and in the second, although its habitat ranges from 4,000 to 10,000 feet, the chief forests probably lie between 6,000 and 8,000 feet, or precisely at that elevation where villages and cultivation are chiefly located. The result of its narrow distribution is that the forests of deodar from the Alaknanda river in the east to Afghanistan are almost exclusively in Native States. The few exceptions within British territory are the forests of the Jaunsar Bawar, those of the Kulu valley, and the limited areas in the Khagan valley, of which Government owns a share only. These forests, after providing for local requirements, can yield annually one or two thousand trees only for export to the plains in the form of sleepers or otherwise. The rest of the deodar-producing tracts are situated in the different Native States extending from Tehri Garhwal in the east, to Kashmir and Afghanistan on the west; but the British Government have taken measures to insure the sound working of, and the maintenance of a permanent yield from most of these. The forests of Bashahr, Chamba, a portion of those of Tehri Garhwal, and the smaller ones of Raiengarh and Dadi have been leased and are being worked up to, but strictly within, their possible annual yields. Elsewhere in the State forests of Kashmir and the Simla Hill States, such as Jubal and Taroch, the exploitation is based on working plans and the advice of competent forest officers. So that there is in all these cases a guarantee that the forests are being worked and at the same time not over-worked, and at any time information is available as to the number of trees which can be cut during the next 20, 30 or 40 years.

Certain forests in Kashmir, the property of *Jaghirdars*, and those of Mundi and Suket have, so far as our information goes, not been brought under systematic working and from these it is probable that no sustained yield may be looked for, though they have contributed largely to the supply of sleepers in recent years.

Of the deodar forests to the west of the Khagan valley, little appears to be known either as regards their capabilities or the feasibility of working them.

The existing forests are, doubtless, capable of further development, and also of some extension; but there is the insuperable obstacle to this latter on any large scale, that the zone in which deodar thrives is also the densely-populated part of the Himalayas, and compact areas of suitable land cannot be acquired. Everything possible, where the control or influence of the Government can be exercised, is being done both to extend the area under deodar, and to increase the proportion of that valuable species in forests where it occurs mixed with other trees. There is no case for a syndicate with capital to carry on this work, since the available trees for many years to come are too few to afford continuous timber operations on a

sufficiently large scale, and no company could be floated (even if land could be acquired) to simply undertake the planting up of areas with trees which take 120—150 years to mature. The only sound plan is to exploit the forests to their utmost capability, that is, to make available the largest possible *annual* yield, based on an enumeration of growing stock ; and to improve their productive power by careful protection and plantings. A monied company would, no doubt, be very pleased to anticipate the yield of the next 40 or 50 years and to work out the whole of the marketable trees in the course of 3 or 5 years, but such a procedure would ruin the reproductive power of the forests and put an end to their permanence; for silvicultural exigencies, equally with the necessity for providing a regular annual income to the proprietors, make it imperative that the removal of the marketable trees shall be spread over the time required for younger trees to take their place.

The results of any more rapid working would be ruined forests, a suspension of revenue and of sleeper supply, lasting for many years, and doubtful re-establishment of the forests or restoration of deodar wood supplies.

It is often stated that it is not the business of the forest officer to convert and carry to the market, or the sea-board, the timber and produce of the forests. It is argued that such work is better done by the middleman, and more cheaply carried out by private enterprise. The merchant is said to better understand the business of trade and the markets than can the Government officer; and this may often, if not always, be true; but it is usual to overlook a factor of much importance in working out timber by Government agency. The protection and management of the forests involve the up-keep of a considerable establishment, both of European controlling officers and of native executive staff: and this establishment is available at no additional outlay for the supervision and carrying out of timber works. The natural outcome is a saving of at least 25 per cent. compared with the cost of similar work done by private and independent traders. This saving has the effect of enabling timber and produce to be put on the market at a profit to the owner of the forest, whereas no private individual could afford to work it at all.

In conclusion, we would also lay stress on the short-sighted policy of the Railway authorities in from time to time combining to reduce the price of sleepers below that at which they can be delivered in quantity, or at all, from the more distant forests. Such action has a most mischievous influence and does more than anything else to check and curtail the regular supply of sleepers. If it is admitted that the deodar sleeper is the best and the cheapest, let there be an end of the struggle to purchase it at three rupees a broad gauge,

and one rupee and eight annas a metre gauge piece delivered on the railway lines, at which it is quite certain only a limited and ever-decreasing number will be worked out of the forests. Let the railway companies realize that, to stimulate the extraction of the possible yield of the forests, they must pay prices at which sleepers can, from all parts of the deodar-producing zone, be extracted at a profit; and they will not fail to obtain all that the forests can at present give, and be further instrumental, without the aid of syndicates or capitalists, in favouring the adoption of what measures are feasible for the improved and enhanced outturn of the forests.

A new species of Albizzia.

In January 1877, when I had the pleasure of visiting the Moharli reserve in Chanda, Mr. R. Thompson, then in charge of the forests in that district, drew my attention to a species of *Albizzia*, similar to *A. odoratissima*, but quite different, and afterwards sent specimens in flower.

At the time I determined, if it really turned out to be a new species, to call it *A. Thompsoni*. More than 20 years have elapsed since then, and I have only now, after an examination of the rich material at Kew, come to the conclusion, that it must be regarded as a distinct species, which I hope now to be permitted, with a few other novelties, to describe in the Journal of the Linnean Society. It is a large tree with spreading branches, attaining a girth of 6 to 7 feet. In January and February it is bare. By the end of February or in the beginning of March the first leaves appear, together with the flowers. The flowers are pale yellow, anthers pink, while *A. odoratissima* has fragrant flowers and yellow anthers, which in Chanda appear much later, towards the end of April and in the beginning of May.

Mr. Thompson informed me at the time, that he had often found it associated with *A. odoratissima* in the Moharli and other forests of the Chanda district. Its native name is Sitari, while *A. odoratissima* in that district is called Chichwa.

Young leaves and branches are softly tawny-tomentose. The leaves are larger than those of *A. odoratissima* but the leaflets are a little smaller. The chief distinguishing characters are, that the flowers are pedicelled and that the ovary and young pods are perfectly glabrous and shining dark brown. In *A. odoratissima* the flowers are sessile, the pods when young velvety, and only glabrous when full grown.

It is, however, remarkable that this species is as yet only known from the Ohanda district. Of the species hitherto described, *Albizzia schimpesiana*, Oliner, of Abyssinia, resembles it most.

Perhaps the following key to the Indian species of *Albizzia* may be found useful.

I. Pinnæ 1 or 2 pair, leaflets 1-3 pair, 3-5 in. long.

1. *A. lucida*, Benth.

II. Pinnæ 2 to 12 pair, leaflets $\frac{3}{4}$ in., rarely $\frac{1}{2}$ in. long and more. Midrib, if not quite in the middle, never near upper edge of leaflet.

(a) Flowers sessile.

Pinnæ 3-4 pair, leaflets 1 to 2 in. long.

2. *A. procera*, Benth.

Pinnæ 3-8 pair, leaflet $\frac{3}{4}$ to 1 in. long

3. *A. odoratissima*, Benth.

(b) Flowers pedicellate.

Pinnæ 3-4 pair, leaflets 1 to 2 in. long, pods straw coloured.

4. *A. Lebbek* Benth.

Pinnæ 6-12 pair, leaflets $\frac{3}{4}$ in. long, pods brown, glabrous, shining.

5. *A. Thompsoni*.

Pinnæ 6-12 pair, leaflets $\frac{1}{2}$ to $\frac{3}{4}$ in. long, pods straw coloured.

6. *A. pedicellata*, Baker.

III. Pinnæ 6 to 18 pair, leaflets less than $\frac{3}{4}$ in. long.

(a) Midrib near middle of leaflet, leaflets linear.

Pinnæ 7-12 pair, leaflets $\frac{1}{2}$ in. long, flowers very shortly pedicellate, heads funicled. 7. *A. amara*, Boivin.

Pinnæ 12-20 pair, leaflets less than $\frac{1}{2}$ in. long, flowers sessile, heads paniculate. 8. *A. myriophylla*, Benth.

(b) Midrib close to upper margin of leaflet.

Pinnæ 6-12 pair, leaflets oblong-falcate $\frac{1}{2}$ to $\frac{3}{4}$ in. long, flowers pink, 1-1 $\frac{1}{2}$ in. to extremity of stamens.

9. *A. Julibrissin*, Durazz.

Pinnæ 6-15 pair, leaflets $\frac{1}{2}$ to $\frac{1}{2}$ in. long, linear-falcate, flowers $\frac{1}{2}$ to 1 in. long, stamens slightly tipped with red. Stipules large, deciduous.

10. *A. stipulata*, Boivin.

All these are trees, except *A. myriophylla*, which Sir George King in his excellent paper "Materials for a Flora of the Malayan Peninsula," describes as an evergreen, unarmed shrub or strong climber, 15-20 ft. long when climbing, 8-12 ft. high if unsupported. In this species the base of the petiole is prolonged downwards and is hardened into a recurved almost woody hook. *A. pedicellata* is as yet known only from the Malay Peninsula.

Kurz, in his *Forest Flora of British Burma*, mentions also *A. elegans*, Kurz, and *A. Teysmanni*, Kurz. Of these I have seen no specimens. *A. elegans* was called by him, in Appendix A. List of Burman Forest trees, doubtfully, *A. lebekoides*, Benth.

This, however, which has also been reported from Upper Burma in no way differs from *A. odoratissima*. *A. elegans* seems to stand nearest to *A. stipulata*. In Asiatic Soc. Journal, Vol. 45 II, p. 299 Kurz'says: Very similar to *A. stipulata*, but a much more elegant tree. *A. Teysmanni* is near *A. procera*, but with much larger leaflets.

D. BRANDIS.

The Indian species of *Anogeissus*.

In April 1868 I found on the Pachmarhi hills a species of *Anogeissus*, which struck me as peculiar. The same species I collected afterwards in the Garhakota forests, Saugor district, in December 1876, and again on the Pachmarhis in April 1877. It reminded me of *Anogeissus acuminata*, the well known Yônbin of Burma, but the branches were stiff and not hanging over as in the Burmese tree, and the leaves were quite different, broadly elliptic, with a very short point. The flower-heads are single, as in *A. acuminata*, not in axillary racemes, as in *A. latifolia*, and instead of the small deciduous bracts of the Yônbin, the peduncles of the new species frequently bear several pairs of small leaves. In the Kew herbarium are also specimens collected by the late Mr. Dulzell in the Panch Mahals of Guzerat, and by Mr. J. F. Duthie in February 1891 on the Pachmarhis (marked by him *A. acuminata*).

And what I am disposed to regard as a variety of the same species has also been collected in Merwara by A. E. Lowrie, about 1884, and by Mr. Duthie in January 1886. These Merwara specimens have short and broad leaves, clothed with greyish velvety tomentum, and some peduncles are branched, bearing several flower-heads. The flower-heads are smaller, but the structure of flower and fruit is the same. Mr. Lowrie states, that the tree flowers from November until February, and that it goes lower down into the plains of Marwar, than the other species of the same genus.

The Indian species of *Anogeissus* I am disposed to define as follows :—

I. Persistent calyx. tube shorter than fruit.

1. *A. pendula*, *Edgew.* Dhao, Merwara.—A small gregarious tree, with pendulous branches, leaves turning red in January before falling. Branchlets and leaves densely clothed with short, soft, adpressed hairs. Leaves $\frac{3}{4}$ to 1 in. long, broadly lanceolate or oblanceolate, secondary nerves 5-7 pair, not prominent.

Flower-heads under $\frac{1}{2}$ in. diameter, on slender axillary peduncles $\frac{1}{2}$ to 1 in. long. The ripe fruit, with wings about as broad as long, nearly orbicular. The upper portion and the short beak hairy, the lower portion glabrous.

Rajputana and Bandelkhund, extending south to the Panch Mahals and to Nimar on the Nerbudda river. The principal forest tree in Merwara and Meywar.

II. Persistent calyx, tube longer than fruit.

2. *A. latifolia*, Wall., Dhaura, Hind. Dindaga, Kan. A large tree. Leaves $1\frac{1}{2}$ to 4 in. long, broadly elliptic, obtuse at both ends, pubescent when young, generally glabrous when full grown, petiole one-fifth the length of blade. Secondary nerves 8-14 pair. Tertiary nerves prominent on the underside of leaf, parallel and anastomosing. Flower-heads $\frac{1}{2}$ to $\frac{3}{4}$ in. diam. on short peduncles, often in axillary racemes, ripe fruit nearly glabrous, shining, with the wings almost orbicular.

Sub-Himalayan tract, from the Ravi eastward, ascending to 3,000 ft., Central India, Peninsula and Ceylon, up to 4,000 ft. on the Nilgiris. Not known from Assam and Burma.

3. *A. sericea*, Brandis, Khardi, Pachmarhi. A moderate-sized tree, branchlets and underside of leaves clothed with long silky hairs. Leaves $1-1\frac{1}{2}$ in. long, elliptic, shortly acuminate, on short petioles. Secondary nerves 4-6 pair. Flower-heads $\frac{3}{4}$ in. diam., single, on long peduncles, which frequently bear a number of leafy bracts. Fruit tomentose, with the wings broader than long, wings jagged. Calyx often persistent, at the end of the long tube.

Nagpahar in the Mandla district (R. Thompson). Common on the Pachmarhi hills at 3,000 to 4,000 ft., Garhakota, Sangor district, Panch Mahals, Gujerat. A variety with smaller greyish pubescent leaves, and smaller flower-heads ($\frac{1}{2}$ in. across), in Merwara (Lowrie).

4. *A. acuminata*, Wall. Yōnbin, Burma. A large tree with pendulous branchlets. Young shoots and underside of full grown leaves soft pubescent. Leaves elliptic-lanceolate, acuminate, 1 to $2\frac{1}{2}$ in. long, on short petioles. Secondary nerves 6-8 pair, arcuate. Flower-heads on short peduncles, $\frac{1}{2}$ to $\frac{3}{4}$ in. across. Fruit with wings generally broader than long.

Ganjam, Godaverv, Chanda district, Chittagong, Burma.

5. *A. phyllirensifolia* Neurck et Muell. Arg. (Flo. B. Ind. II, 451) is a variety of *A. acuminata* with narrower more glabrous leaves and smaller flower-heads, chiefly found in the dry country of the Irawaddy valley, between Prome and Mandalay, analogous to the variety, with smaller leaves, of the dry hills of Merwara.

II.—CORRESPONDENCE.

Tannin materials used in the Damoh district, C. P.

You will, no doubt, be pleased to publish the following interesting account by Mr. R. S. Hole, Assistant Conservator of Forests, of the tanning materials used in the Damoh District of these Provinces, and the methods of employing them. Few persons are aware of the excellent quality of the leather prepared with the fruit of *Zizyphus xylopyrus*. It is a most widely-spread species and fruits abundantly nearly every year. Both Brandis and Gamble very strangely ignore the use of the fruit as a tanning material and speak of the bark being thus employed. I think that for the word "bark" they should substitute "fruit." The Director of the Forest School should make an extract of the fruit for experiment, as the species is abundant in the Saharanpur forests.

18th March 1899.

E. E. FERNANDEZ.

The methods of tanning leather employed by the local chamars of the Damoh district.—The hides before treatment with the tanning materials are subjected to the "liming" treatment to get rid of the hair and flesh. The time occupied by this process varies according to the quality and kind of hide, a very thick hide taking a longer time to clean than a thin one, and a green hide longer than a hide which has been partially dried; but, as a rule, the liming occupies from one to three weeks. The quantity of lime used also varies according to the hide, a fresh green hide requiring more lime than a partially dried one; and a large hide, such as that of a buffalo or bullock, requiring more than a small hide like that of a goat. The amount of lime used, and the time occupied by the process, also varies according to the skill of the tanner, the *chamars* in the small villages and out-of-the-way places using more lime and subjecting the hides to its action for a longer time than those of the large villages and small towns, where there is more demand for leather and where the tanners have, in consequence, to take more trouble with the preparation of their goods.

A certain quantity of lime (7 seers for a buffalo hide, 5 seers for the hide of bullock or cow, and $\frac{1}{2}$ seer for that of a goat) is first mixed up with 6 to 8 seers of water, and is then applied to the inner side of the hide. The hide is

now folded up and the two ends tied, the whole being then placed in a *nand* or large earthen pot, containing 2 to 4 seers of lime, and sufficient water to entirely cover the hide, usually about 20 seers, the latter being kept under water by means of a heavy stone. The hide is left here for three days when it is taken out of the *nand*, unfolded and rubbed with the lime which has already been applied to it. Some *chamars* then replace it loose in the *nand* without folding it up again, and then leave it in the *nand* for 4 or 5 days, when it is taken out, rubbed, cleaned and scraped. It is then ready to be tanned, after being washed in clean water. If the hide is very thick, the hair and flesh cannot be removed so quickly, and the hide has to be again placed in the *nand*, after it has been rubbed, where it remains for 5 or 6 days. It is then taken out and finally cleaned. I was informed that the largest and thickest hides never took more than 15 days to clean in this way.

Other *chamars*, having rubbed the skin with the lime in which it has been soaked for 3 days, again fold it up and tie it at each end before replacing it in the *nand* where it remains for about 9 days, the skin being taken out every 3 or 4 days and rubbed by hand. At the end of this time, i.e., on the 12th day, the hide is taken out of the *nand*, is rubbed with the rib bone of an animal and scraped with a *khurpi* and *rampi* (iron implements used by *chamars* and shoemakers for cutting leather), the hair and flesh, which have become loosened by the action of the lime, being thereby removed. The skin, which is now white, is then usually soaked in clean water for about 12 hours, when it becomes fit for treatment with the tanning materials or for being put in the so-called *kas* or tanning liquor. If, however, the skin is very thick and it is found impossible to remove all the flesh, the hide, after being rubbed and scraped, has to be replaced in the *nand* for 7 or 8 days, it being taken out and rubbed twice more before it can be thoroughly cleaned. It is then washed with clean water as before.

These remarks apply to fresh, or fairly fresh hides; but if the hide is dry, it is put into a mixture of water and from $\frac{1}{2}$ to 7 seers of lime (according to the size and kind of the hide), and is left there for about 15 days, when it is taken out and finally cleaned with the *khurpi* and *rampi*.

As far as my enquiries have shown, there appears to be no "graining" or "bating" process, and beyond washing the hide in clean water after the liming, nothing is done to get rid of the lime which remains in the skin.

The principal materials which are used for tanning by the local *chamars* are:—

(a)	Leaves of	<i>Dhaora</i>	(<i>Anogeissus latifolia</i>)
(b)	" "	<i>Aonla</i>	(<i>Phyllanthus Emblica</i>)
(c)	" "	<i>Jamrassi</i>	(<i>Elæodendron Roxburghii</i>)
(d)	" "	<i>Saj</i>	(<i>Terminalia tomentosa</i>)

(e)	Bark of	<i>Koha</i>	(<i>Terminalia Arjuna</i>)
(f)	" "	<i>Kirwara</i>	(<i>Cassia Fistula</i>)
(g)	" "	<i>Bamura</i>	(<i>Acacia arabica</i>)
(h)	<i>Harra</i> fruit		(<i>Terminalia Chebula</i>)
(k)	<i>Ghaunt</i> "		(<i>Zizyphus xylopyrus</i>)
(l)	<i>Bahera</i> "		(<i>Terminalia belerica</i>)

These materials are collected, dried, crushed and powdered and are then kept for use. Materials (l), (c), (e), (f), (h) and (i) are, however, rarely used by themselves, and are only employed when it is desired to impart a particular colour to the leather or when better materials are not obtainable. If used at all they are generally employed in combination with *dhaora* leaves, materials (b) and (c) producing leather of a whitish colour, (e) and (h) leather of a yellow colour, and (l) a reddish leather. All large hides, such as those of a buffalo or bullock, are cut in two before being tanned, each half being tanned separately.

The methods of tanning principally employed are as follows:—

Method of tanning with ghaunt and dhaora leaves. The first liquor or *kas* is prepared from 5 to 6 seers of *ghaunt*, which has been dried and powdered, mixed with 20 seers of clean cold water in a *nand*. This is left standing for about one hour, when the colour of the *ghaunt* diffuses into the water. The hide remains in this liquor for 3 days, it being taken out twice to thrice every day and rubbed with the hand for about one hour. At the end of the third day the hide is taken out of the *nand*, rubbed, wrung out, and spread to dry for about 2 hours.

The second *kas* or liquor is prepared from 7½ to 8 seers of *ghaunt* mixed with 20 seers of clean water, in which the hide remains for 4 days, it being taken out, rubbed and worked three times daily. After 4 days it is taken out, wrung out and dried as before and is then put into the third *kas*. This consists of 6 to 7 seers of *dhaora* leaves mixed with 20 seers of water and the hide remains in this for 2 days, being rubbed daily as before and on the third day it is wrung out and dried. Some *chamars* mix *dhaora* leaves with the *ghaunt* in the second *kas*, the proportions being 3 seers of *dhaora* leaves or *kaspatti*, 3 seers of *ghaunt* and 20 seers of clean water. In this case a third *kas* is not always necessary. A piece is cut from the edge of the hide to see if the colour has passed right through the skin, and if it is found that the hide is whitish in the interior, it is considered to be insufficiently tanned and a third *kas* is accordingly given, it being a repetition of the second.

Other *chamars* again mix no *ghaunt* in the second *kas*, which consists of 5 to 6 seers of *dhaora* leaves or *kaspatti*, and 20 seers of water; and in this case no third *kas* is given.

In all cases, however, after treatment with the *kas* (or liquor) as described, the hide is sewn up like a bag with the bark of *Kulu* (*Sterculia urens*), root of *Chheola* (*Butia frondosa*) or leaves of *Khajuri* (*Phoenix sylvestris* and *acaulis*), leaving an aperture of about a span's width at one end. It is then hung up on a pole, the opening being uppermost, and is filled half with *dhaora* leaves and half with water. The quantity of leaves used depends on the size of the skin and kind of leaves used. About 4 or 5 seers are necessary for a goat's skin and from 16 to 17 seers for half a hide of a buffalo or cow. Also if the leaves are young, more is used than is the case if the leaves are old. A *nand* is placed below the hide so that the solution which filters through the skin is collected in it. The contents of this *nand* are poured back into the hide 4 times during the day and 4 times during the night. This continues for 2 days, when the aperture is sewn up, the bag reversed and an opening made in the bottom of the bag, which is now uppermost, and the process continues as before for one day and a night, the object of this being to get both the upper and lower portions of the skin thoroughly impregnated with the solution. The hide is then taken down, opened, washed in clean water and dried. It is then rubbed well for about half an hour with $\frac{1}{2}$ seer of salt mixed with one seer of curds, when it is left to dry and the operation is complete. The leather produced by this method is of a yellow colour.

Method of tanning with ghaunt alone.—In this case the hide is merely treated with 3 liquors and is not hung up as in the last method. The *kas* consists of 6 to 7 seers of powdered *ghaunt* and 20 seers of water. The hide is left in this for 3 days and is taken out and rubbed 3 times daily. After being wrung out and dried it is put into a second *kas* similarly prepared, in which it remains for 5 days, being rubbed daily as before. It is then put into the third *kas*, also of the same composition as the first, and it remains in this for 8 days, being rubbed daily as before. It is then washed, dried and treated with salt and curds as described in the first method. The leather made by this process is of a reddish colour. If unripe *ghaunt* is used, a lighter colour is produced than is the case when thoroughly matured fruits are employed. The leather prepared by these two methods is said to be the best. It does not crack and this is ascribed to the use of *ghaunt*.

Method of tanning with dhaora leaves alone.—The process is much the same as described above in the *ghaunt-dhaora* method. The first *kas* in this case consists of about 6 seers of *dhaora* leaves and the second and third of 8 seers, the quantity of water used being the same in each, i.e., about 20 seers. The hide remains in the first *kas* for 3 days, in the second 4 days and in the third 2 days. After treatment with the *kas* the hide is hung up and filled half full with *dhaora* leaves and half with

water and is treated just as described above. The leather produced by this method is of a greenish yellow colour and is very liable to crack. To prevent this the leather is rubbed with the *tilli* oil.

Method of tanning with dhaora leaves and harra.—This is exactly the same as the last with the exception that half the quantity of *dhaora* leaves is used mixed with an equal quantity of *harra*. The leather produced is of a brighter yellow than the last but is also liable to crack.

Aonla and *jamrassi* leaves, *bahera* and *koha* bark are generally only used in combination with *dhaora* leaves, the method being the same as that already described, with the exception that a less quantity of *dhaora* leaves is used and more or less of one or other of these substances mixed with it, according to the colour of the leather it is wished to produce. According as the quantity of *aonla* or *jamrassi* leaves, of *bahera* or of *koha* bark predominates is the leather yellowish-white, white, reddish-brown or yellow.

Method of tanning with saj bark alone.—In this case the hide is usually treated with *kas* or liquor five times as follows:—

The first *kas* consists of 3 or 4 seers of powdered bark mixed with 20 seers of water, the second of 5 seers of bark, the third of 7 seers, the quantity of water remaining the same throughout. The hide remains in the first *kas* for 3 days, in the second 5 days, in the third 6 days, in the fourth 7 days and in the fifth 8 days, it being taken out and rubbed 3 times daily as previously noted. It is then taken out of the *kas*, washed in clean water and dried, after which it is well rubbed by hand. The leather thus prepared is of a dark, brownish-red colour, of good quality and does not crack.

Instead of *saj* bark, *hamura* bark is also occasionally used alone, the method of tanning being precisely similar in the two cases. The leather produced is of a reddish-brown colour and of good quality.

A black dye for leather is occasionally prepared by making a mixture of *mahua* flowers and water and then putting iron slag into it, the whole being left to digest for 7 or 8 days.

III.—OFFICIAL PAPERS & INTELLIGENCE

A Vernacular Forest School for Burma.

The attention of the Government of Burma has for some years been directed towards the need for increasing the staff of Officers entrusted with the management of the valuable teak forests in this province, but more particularly to improving the effi-

ciency of the comparatively limited number of Native Rangers and Foresters on whom devolves the duty of immediately superintending various important operations instituted by the Controlling Officers.

The class of men who usually enter the Subordinate Forest Service in Burma are eminently fitted to undergo hardship and exposure, and they are naturally intelligent as well as practical. But, unfortunately, beyond being able to read and write Burmese, they are as a rule almost without education of any kind and therefore incapable of fully comprehending the object of any instructions they receive, so that they are apt to carry out orders mechanically, without due regard to surrounding conditions.

On several occasions, dating back to 1883, the local Government deputed Burmese students to the Imperial School at Dehra Dun to study there, but few of the Burmans profited much by the training they received owing to their being unable to keep up with the lectures, delivered in English, to the Upper class of students, and from their want of knowledge of Hindustani, to follow the simpler course in the Vernacular classes.

The only means of training Burman Rangers or Foresters, and Shans, Karens, or others who understand Burmese, is to instruct them in the language of the country and to illustrate the lecture delivered to them by examples from the local forests, which they are familiar with, or which can be shown.

This consideration perhaps, and also the desirability of saving the inconvenience of deputing men to such a distance as Dehra Dun, led, not long ago, to the Local Government deciding to establish a Vernacular Forest School in Burma. A scheme was submitted to the Secretary of State for India and duly received his sanction. In May 1898, measures were taken for carrying out the provisions of the scheme, with the result that very probably by the beginning of August of this year the school will have been opened and the training of the first batch of students actually begun.

The following is a brief outline of the constitution of the school and of its proposed management.

The school is to be under the administrative control of the Conservator of Forests, Pegu Circle, who will ordinarily be assisted by a Board of Control consisting, besides himself, of one of the Conservators from Upper Burma, the Deputy Conservator of Forests, Tharrawaddy Division, and of the Inspector of Schools, Central Circle.

The school is to be at Tharrawaddy, the head-quarters of the Division of that name. It is a small station on the Irrawaddy Valley Railway, 68 miles from Rangoon, and was chosen as the best place in which to establish the school; as, owing to the comparatively advanced stage to which forest organization has been brought in the Tharrawaddy Division, exceptional

facilities would be afforded for giving the students who joined the school a thoroughly practical training, by offering them opportunities of acquiring from personal observation, or from actual experience in the forests and plantations, a clear idea of the object and conduct of forest operations.

As to the course of instruction the students are to go through. This will include a series of lectures on forestry, dealing with silviculture, utilization, working plans (their object and application), forest laws and organization, elementary surveying and engineering, and the keeping of forest accounts and returns. The theoretical instruction will, for the immediate future, be of an elementary and simple character, such as is suited to the class of Burman, Shan, Karen, or Kachin usually entering the Subordinate Forest Service. The chief aim to be kept in view is to make the *practical* training as thorough as possible.

The school staff will consist of the Officer-in-charge of the school, who has been selected for the post from amongst the senior Extra Deputy Conservators in Burma. He will be assisted by the Forest Rangers and Clerks of the Tharrawaddy Division (under instructions given by the Divisional Officer) in the practical training of the students in the "field" or elsewhere. The School Divisional Officer in addition to teaching, will be entrusted with the general administration of the school and the carrying out of the orders of the Board of Control.

A term of eighteen months has been fixed as the length of the school course, and of this term from three to four months will be devoted to practical work in the forests, combined with elementary theoretical instruction. The examinations for certificates will be conducted by the Board of Control, who will grant to the successful candidates, according to their respective standard of qualification, either :—

- (1) A *higher* certificate qualifying the holder to serve as Ranger or Deputy Ranger, or
- (2) A *lower* certificate making the holder eligible for a vacancy in the grade of Forester.

Appointments are to be made to existing vacancies in the Subordinate Forest Service from certificated Rangers and Foresters according to the position attained by the students at the final examinations.

To induce candidates to come forward from the better educated classes, for admission to the school, two stipendiary appointments are offered, the stipend being payable during the attendance of the students at the school.

At present it is intended to have a class of eight students comprised of :—

- One Forester.
- Three Forest Guards.
- Two stipendiary students.
- Two non-stipendiary students.

If no suitable non-stipendiary students are forthcoming, their place will be filled by stipendiary students. The students (paid or otherwise) are to be recruited at the rate of two from each of the four Circles in Burma, or else in such proportion as the local Government may direct. The rules for the admission are very similar to those regulating the admission of students to the Imperial Forest School at Dehra Dun, certificates of age, health and character being required as usual; but it is laid down in addition, that none but natives of Burma will ordinarily be taken into the school.

The Supply of Sleepers.

The following Circular has been addressed by the Inspector-General of Forests to all Conservators.

It has been arranged with the Public Works Department of the Government of India that this Office shall, in future, be supplied with early information regarding the requirements of all State Railways in India for sleepers, timber, fuel, etc. In return, I have undertaken to supply that Department with the following particulars :—

- (1) Names of timber depôts belonging to the Forest Department in every province, and the Civil District in which each depôt is situated. (Where there are no Government timber depôts, the names of central places where timber and sleepers might, if necessary, be arranged for may be given.)
- (2) Distance of depôt from Railway station
- (3) Cost of carriage per cubic foot from depôt to Railway station.
- (4) Species of timber available.
- (5) Probable annual supply available, or which would be arranged for, of wood fit for sleepers.
- (6) Prices of broad and narrow-gauge sleepers.

Imperial Institute.

Quarterly Report by Professor Wyndham Dunstan, F. R. S., Director of the Scientific Department on Enquiries conducted for the Government of India.

The attention of the staff of the Scientific and Technical Department has been almost exclusively occupied with Indian enquiries during the past three months.

Investigations of Indian opium, Indian hemp, Indian oils, Indian fibres and other Indian products have been actively proceeded with, and the following reports have been made and despatched to India.

Indian Fibres—A report has been made on the fibres of *Calotropis gigantea* (Madar fibre) from Madras, and *Villebrunea integrifolia* (Ban-Riha), from Assam. The latter fibre has given very promising results which seem to indicate that this fibre may be superior to that known as China grass. At the same time, the untreated fibre was submitted for examination and it would be premature to pronounce a definite opinion until further samples of the treated material have been received from India.

The representative of one of the largest cocoanut fibre manufacturers in the United States made an enquiry as to the possibility of obtaining a large and regular supply of this fibre from Madras. After inspecting the samples exhibited in the Indian Section, which he stated were very satisfactory, he desired that authentic information on this subject should be supplied to him with the view of opening up a new supply for the American factory, which had hitherto been met from the West Indies. The request for this information has been forwarded to the Reporter on Economic Products to the Government of India.

A specimen of Sabai fibre was forwarded by Professor Marshall Woodrow, of the College of Science, Poona, with a request for information as to its commercial value. This was obtained, and a report forwarded to the Reporter on Economic Products with a request that he would communicate with Professor Woodrow on the subject.

A request from a fibre broker for samples of *Tacca* fibre, produced in India, with the view to a supply being obtained for this country, has also been referred to the Reporter on Economic Products.

Indian Oils.—The large and representative collection of samples of edible oils which has reached the Institute during the last few years has now been examined. Since the whole staff of the Scientific Department was already fully occupied, I arranged with two of my assistants in the chemical laboratory of St Thomas' Hospital, who had given particular attention to this subject, to undertake the preliminary survey of these oils. The voluminous report thus made has been forwarded to India, whilst a paper by Dr. Crossley and Mr. Le Sueur has appeared in the "Journal of the Society of Chemical Industry." It is hoped that in this way attention may be drawn to the merits of these oils.

Indian Medicinal Plants.—Since the publication of the last paper on the Indian Aconites a memoir entitled—"The Pharmacology of Aconitine, Di-acetyl-aconitine, Benzacoinine and Aconine, considered in relation to their chemical constitution," communicated to the Royal Society by Professor Cash, F. R. S., of Aberdeen, and myself, has been printed in the "Philosophical

Transactions.' A reprint of this paper has been forwarded to India, as it contains much information which is likely to be of value to those who are interested in the medical employment of aconite. Further work on the alkaloids of the Indian aconites has been in progress and will shortly be reported upon.

In connection with the previous work on the chemistry of Indian Podophyllum a paper has now appeared by my colleagues, Drs. Mackenzie and Dixon, of St. Thomas' Hospital, on the medicinal effect of Indian Podophyllum and of the products derived from it. (Edinburgh Medical Journal, November, 1898.) This investigation, which was undertaken with the view of comparing the effects of Indian Podophyllum with those of American Podophyllum has proved that the Indian drug is a complete, and probably particularly satisfactory, substitute for the American product. Since this subject has now been fully investigated, both on the chemical and on the medical side, and it is proved that the chemical constituents of *Podophyllum emodi* are identical both in their composition and action with those of *Podophyllum peltatum*, it is to be hoped that steps will at once be taken in India to develop the utilization of this plant for the extraction of the podophyllin, for which there exists a considerable demand in English and Continental markets.

The investigation of the constituents of Indian henbane, *Hyoscyamus muticus*, has now been completed. The report has been forwarded to India and a paper is about to appear in the Journal of the Chemical Society of London. It has been shown that this plant contains the alkaloid hyoscyamine, for which there is considerable demand in medicine; and further, that this alkaloid can apparently be more readily extracted from Indian henbane than from the other plants which are now resorted to for this purpose.

Indian Foodstuffs.—A report has been made by Professor Church, F. R. A., on *Cyanotis axillaris* and on three species of Indigofera,—*i. linifolia*, *i. glandulosa* and *i. cordifolia*, and forwarded to India.

Professor Church has also reported on the suitability of Ragitalings as a prison food in India.

Indian Woods.—A sample gunstock made from Pynma wood, *Lagerstrœmia Flos-Reginæ*, under the supervision of the Director-General of Ordnance Factories, was reported by him to be unsuitable, chiefly on account of the number of knots and galls in the plank. Otherwise the wood seemed suitable for its purpose and the question therefore remains whether a supply of this wood can be obtained, which is comparatively free from these deficiencies.

In concluding this Quarterly Report on the work done for the Government of India in the Scientific and Technical Department, I would point out the necessity of prompt action being taken in India, with a view to the commercial utilization of those products which have been examined and favourably reported upon

by this Department. It is most important that proper organization should exist in India for at once determining how such raw materials may best be utilized and regularly supplied to the proper manufacturers or consumers.

(Sd.) WYNDHAM R. DUNSTAN,

Director, Scientific and Technical Department.

5th January 1899.

Imperial Institute.

Spanish Chestnuts as a food-supply.

The following extracts have been forwarded by Sir W. T. Thiselton Dyer to the Secretary of State with the suggestion that the cultivation of the Spanish chestnut might be of value as an auxiliary food-supply.

United States Consular Reports, December 1898 Pages 537 and 538.

CHESTNUTS.

The absence of Indian Corn as an article of diet among the poorer classes in France is, to a certain extent, replaced by the popular chestnut. Throughout the centre of this country, from the Bay of Biscay to Switzerland, there are large plantations, and almost forests, of chestnut trees. These nuts differ very much from the ordinary species indigenous to the United States; they are broad, large, and resemble the American horse chestnut or buckeye (*Æsculus hippocastanum*), and are extensively eaten by human beings and animals. Great care is taken in harvesting this nut before the severe frosts touch it, as freezing hastens fermentation.

The poor people, during the fall and winter, often make two meals daily from chestnuts. The ordinary way of cooking them is to remove the outside shell, blanch them,* then a wet cloth is placed in an earthen pot, which is almost filled with raw chestnuts; they are covered with a second wet cloth and put on the fire to steam; they are eaten with salt or milk. Hot steamed chestnuts are carried around the city streets in baskets or pails; the majority of the working people, who usually have no fire early in the morning, eat them for their first breakfast, with or without milk. Physicians state that, as an article of

* This is done by throwing the nuts into boiling water and with a "brigquette" rubbing them around the kettle until the inside skin falls off. The brigquette is composed of two square pieces of wood, 24 to 30 inches long, the angles of which are notched 1 foot up; they are joined like shears with a rivet.

food, chestnuts are wholesome, hearty, nutritious and fattening. These nuts are often used as a vegetable and are exceedingly popular, being found on the table of the well-to-do and wealthy. They are served not only boiled, but roasted, steamed, puréed and as dressing for poultry and meats.

Chestnuts are made into bread by the mountain' peasantry. After the nuts have been blanched, they are dried and ground. From this flour, a sweet, heavy, flat cake is made. It resembles the oaten cakes so popular among Scotch peasants. They are extensively employed for fattening animals, especially hogs. The nuts are boiled without shelling; only small, inferior fruit is thus used.

In good seasons, chestnuts sell as low as 1 cent a pound retail, and wholesale at \$ 1.50 per 2 cwt.

When these nuts are stored, they are very apt to heat and ferment. Great care must be taken to prevent this; they are placed in cool, airy bins, so that the air can readily pass through the pile and perfect ventilation be obtained.

*United States Consular Reports, December 1898,
pages 540 and 541.*

There are chestnut plantations on the slopes of Etna from about 2,000 to 4,300 feet altitude. The estimated annual production is from 80 to 100 tons. As these groves have been planted more for the use of the timber than the nuts, the latter are, with few exceptions, inferior in quality and size to the fine large chestnuts raised in Calabria (southern part of Italy), which are called "maroni." The young trees on Etna (at least for the most part, I am told) are not grafted; they are raised from nuts, and all the suckers or sprouts are permitted to grow up, and when the largest are of sufficient size for use as lumber, they are cut off, timber being scarce and lumber nearly all imported.

Chestnuts are the only nuts that can be said to enter into the regular diet of the people, their consumption during the fall and winter season (beginning with the gathering of the nuts) being considerable. Almonds, filberts, and walnuts are more a luxury, served as dessert or with wine at social gatherings, and are sold in the streets by the fruit vendors. As in the United States, they are also used by confectioners, the pistachio nuts being used almost wholly in this manner, excepting those exported.

Chestnuts are mostly eaten roasted. They are placed in a sheet-iron pan with handles on opposite sides, perforated with holes about half an inch in diameter, and put over a slow charcoal fire (in a small furnace) until the shells burst open, when they are done. During the roasting process, the nuts must be frequently shaken to prevent them from burning. They are also much eaten in a cooked state; often prepared like a stew with gravy. Besides being served at meals, they are, during the season, offered for sale at the fruit stands or on carts, where they

are freshly roasted and sold hot, like our pea-nuts ; a little salt added makes them more palatable.

As the fresh chestnuts do not keep for a very long time, where they are grown in large quantities, as in Calabria, they are dried until they are as hard as dried peas, then shelled, after horses have been driven over them to crack the shells. In this dry and hard state they can be shipped anywhere, which is not the case with the green or fresh chestnuts, which, when packed for any time, become heated, undergo a sweating process, and soon spoil. These dried nuts are said to be as good for cooking purposes as the fresh ones. They are also sold on the streets and eaten like pea-nuts.

Gregarious Flowering of *Bambusa polymorpha*.

We learn that signs have been observed and reported of an approaching gregarious flowering of *Bambusa polymorpha* over considerable areas of the Pegu Circle Forest. It will now be proved to what extent such an event can be forecast.

Death of Mr. F. E. B. Lloyd, Dy. Cons. of Forests.

We regret to hear of the death, at Weston-super-Mare, on the 31st May last, of F. E. B. Lloyd, Deputy Conservator of Forests. Lloyd joined the Department in December 1893, and put in the whole of his service in Assam ; he first held charge of the Sibsagar and latterly of the Kamrup Division, but owing to a severe attack of fever had to take furlough in October 1898. There seems to be little doubt that he was really suffering from *Kala azar*; for, notwithstanding the greatest care and most skilful nursing, he was never able to shake off the fever entirely to the time of his death. Young Lloyd was one of those whose pluck and cheerful disposition endeared him to all around him, and during his short career in Assam he made many friends who deeply regret his untimely death. Always to the front when work was to be done, he would never take proper care of himself, and though advised strongly to take furlough in April 1898, when he had a sharp attack of fever in Shillong, which was considered to indicate that he then showed symptoms of *Kala azar*, he declined to do so on feeling better, and returned to his work in Gauhati, exposing himself as usual all through the rains in the discharge of his duties. Those who were in Gauhati during the earthquake in June 1897, will ever remember how by his happy manner he helped to cheer up every one during that trying time, and how he was the first there to set about building temporary houses for himself and for his office.

The late M. Henri Barré.

We are sorry to read in the '*Révue des Eaux et Forêts*' of the death at Nancy on the 27th April last of M. Barré who was for so long professor of surveying and engineering at the French Forest School, and who was so well known to all, or nearly all, of those Indian Forest Officers who were trained in France.

M. Barré was born in 1809 and entered the Forest Service as an 'arpenteur forestier,' that is to say, entered the French Forest Survey, in 1843, and was employed in Alsace where he assisted in surveying and in the preparation of the Working Plan for the forest of Haguenau. In 1855 he became professor at the Forest School where he remained until his retirement in 1879. Since his retirement he has lived on at Nancy with his family.

There was no one among the professors and instructors at Nancy that was more generally liked and respected. Always a thorough gentleman, always polite and kind, '*Le Braco*' will be remembered with regret by all those who passed under his instruction, and by his English pupils not less than the others.

IV.—REVIEWS,

The Madras Forest Report for 1897-98.

The settlement of forests in Madras has now gone on for sixteen years and 13,775 square miles are reported as finally reserved to 30th June 1898. It is also shown that this area is to be raised to 20,300 square miles; practically, therefore, 30 per cent. of the work remains to be done. It is scarcely to be expected that the rate of progress will increase, for the blocks as yet unreserved are in populated areas and their reservation is more opposed than the wilder tracts which have already become reserved. It is probable that a portion of the area in the more open country will be abandoned as settlement progresses and shows that it can be reserved only with excessive hardship to the neighbouring population. Apart, therefore, from a few real forests under long disputed ownership, which delays their acquisition, the balance still for settlement represents masses of scrub forests in the plains, of purely local interest and importance, and the present reserved forests comprise most that calls for scientific treatment in the matter of timber growth.

It is, however, clear from the work of the year reported, that the time of district forest officers is still largely absorbed in the mass of petty detail connected with selection, preliminary

survey and settlement. This accounts probably for the smallness of the area of forest under working plans throughout the Presidency which, in this respect, compares unfavorably with the rest of India. On this subject the Government makes the following remarks.—“The correct area covered by working plans at the beginning of the year under review was 184 square miles. Plans for 17 square miles in addition in Tinnevely were completed during the year. Further, the preparation of plans for 897 square miles was continued during the year and a fresh area of 204 square miles taken in hand. Thus, at the end of the year, out of a total area of 19,253 square miles of forests, working plans were either ready or in preparation for 1,302 square miles only. No explanation of this want of progress is offered in the report. The subject appears to have received insufficient attention in all districts, except in Tinnevely, where there are now twelve working circles in which fellings are systematically carried out.”

The work of the year reviewed was much hampered by famine in the North Central Districts, but the revenue was practically maintained at its previous year's total of 21½ lakhs of rupees. It seems noteworthy that Salem, with no great area of forest, yielded two lakhs of rupees after deducting the total outlay on works, yet no working plans are mentioned as being in force. It would be interesting to learn how this revenue was derived, seeing how large it is compared with that of other districts adjoining or similarly situated, so far as can be judged from the statistics reported.

Fire-protection has been carried on as in the past. The total result being 5,321 square miles protected, or 93·6 per cent. of the area attempted, at a cost of Rs 6-13-9 per square mile.

The returns give the area under special protection separately from that under general protection. The object is a good one and is to show the true result of the money spent; which, year by year, is more devoted to areas under organised working, leaving the rest of the forests to less certain protection, involving practically no capital expenditure. The distinction is not clearly enforced or evident by the returns except in the Southern Circle.

Under the head of grazing it is recorded that goat-browsing was permitted in the reserves, and a fear is expressed that the facilities afforded for so doing are insufficient. It is, at first sight, not easy to reconcile the browsing of goats with the encouragement of reproduction over the same area, and the report does not throw light on the subject, but the explanation is found in a separate Government resolution dealing with the subject of forest offences.

“In the four districts in which the reported cases of illicit grazing exceeded 500, it appears that the bulk of the offences were due to the reserved forests being wholly, or almost wholly, closed to the grazing of goats, the number of such cases in South

' Arcot being no less than 800, while the number of goats dealt
' with reached the large figure of 19,758. Even in some of the
' districts in which the total number of cases is not very great, a
' very large proportion of them are cases of illicit goat-browsing
' and a consideration of the reports leaves no room for doubt that
' sufficient attention has not yet been given to Board's Proceed-
' ings, Forest, No. 602, dated 11th October 1895, in which the
' Board communicated to all Collectors, with its general approval,
' Mr. Popert's proposals for making provision for goat-browsing in
' reserved forests. In deference to the varying views of the officers
' consulted the Board refrained from issuing hard-and-fast rules
' for adoption everywhere, and left it to Collectors to arrange
' details to suit the varying conditions of different districts; but this
' was not intended to include an authority to retain total closure
' even in districts in which manifest hardship was being caused to
' the people. No doubt, from a purely forest point of view, the
' total exclusion of goats is very greatly to be desired, but existing
' economical conditions ought not to be wholly ignored in the
' adoption of measures having for their object the good of future
' generations, and in tracts in which goats already abound and
' form the source of livelihood of a considerable portion of the
' people, strict reservation must be confined to a limited area. The
' decision of Government in its order No. 844, dated 29th October
' 1890, to abandon the constitution of village forests and under-
' take the departmental management of grazing grounds has thrown
' on Forest Officers an obligation to provide facilities for goat-
' browsing proportionate to the requirements of the existing popu-
' lation. Mr. Popert in the paper already quoted has very clearly
' pointed out the conditions under which the obligation arises, and
' has made definite suggestions for meeting it, and the Board
' must insist on the method sketched by him being adopted in
' every district in which Collectors are not prepared to submit,
' within six months from the date of these Proceedings, a modified
' scheme better suited to the conditions of their districts, or to
' show that the unreserved lands are sufficient to meet all reason-
' able requirements."

The further results of the Parcellaire system in Kistna are not mentioned but it is noted that the revenue returns from grazing in that district, which previously approached a lakh of rupees, are scarcely over-half a lakh of rupees. If, as is generally understood, the Parcellaire system means charging for each block instead of for a whole forest, the returns should be largely increased instead of diminishing.

The return of demarcation work and its cost shows very varying rates in different districts and this the text of the report does not wholly explain, while the cost of re-clearing is exceedingly high in some parts of the presidency. The form of the return is partly responsible for this, since it can be prepared in different ways and requires a whole series of explanatory notes.

It is satisfactory to read that the Survey of India has made good progress in the Coimbatore and Malamalai forests though only at the expense of the health of the staff which, in the latter region especially, has suffered most severely. Indeed, throughout the presidency, Forest Officers appear to have a most unhealthy life.

The report is a plain statement of unembellished facts and is a resumé of much hard work by the department, which will no doubt be much encouraged if, at the same time surprised, at the word of praise which the Government of Madras, for the first time after many years, has been pleased to bestow upon its efforts.

Injurious Insects of Indian Forests.

BY E. P. STEBBING, F.E.S. *Indian Forest Service.*

There are probably very few foresters in India who have not at times felt the want of a book giving some information about the insects which damage our forests. Mr. Stebbing's new book has now appeared as a pioneer on this subject which when worked out exhaustively, will be a vast one. Only comparatively few of the many insects which attack forest trees have been reported as doing so, and then generally with such very meagre details and accompanied by such poor specimens, usually only one stage of the insect, that correct identification has been impossible.

The present work embodies all the information which is at present available on the subject and includes many original notes and observations by the author.

The plan followed is to describe each insect under its natural order and family in the animal kingdom, and the description usually takes the form of:—

- (1) A mention of the tree or trees attacked and the nature of the damage done.
- (2) A short life-history of the insect.
- (3) Mention of the localities from which it is reported.

The above information will all be most valuable, but a weak point seems to lie in the lack of material given to facilitate identification.

In most cases no description, however simple, of the insect has been attempted. This, we think, might at least have been done for the imago of each species which is not figured, and even where figures are given, a few notes as to the colouring, markings, &c., of the insect would have been most useful in helping to identify any particular forest pest.

The figures, again, are not altogether satisfactory. The majority, including those drawn by the author himself, leave nothing to be desired, but there are others, among which we may mention numbers 12, 27, 30, 43, 44, 46, 47 and 64, which are most indistinct. Some of these latter might in fact have been omitted without detracting from the value of the book, as it is impossible to see clearly what they are intended to represent. Having said this, we have no further fault to find.

The plan of beginning each 'family' with a list of the trees injured by its members, and the nature of each injury, is an excellent one. The index, moreover, at the end of the work, which includes the names of the trees attacked, as well as those of the insects should prove most useful. If, for instance, an unknown insect is found injuring some particular tree, say the *Khair* (*Acacia catechu*) we can run it down at once by looking out *Acacia catechu* in the index and turning up the pages referred to under that species.

With the aid of Mr. Stebbing's book it ought now to be possible, without much trouble, to find out what is known and what is not about any given forest pest, and a large amount of fresh material ought soon to be collected with the co-operation of the many Forest Officers who take an interest in the subject, when it is hoped that Mr. Stebbing will bring out a new and extended edition of his most useful work.

VI.-EXTRACTS, NOTES AND QUERIES,

The flowering of Seedlings of *Dendrocalamus strictus*.

On page 22 of the January number of this Magazine, Sir Dietrich Brandis in his "Biological Notes on Indian bamboos" described the flowering of some 2-year-old bamboo plants in the Patiala State Gardens near Kalka. Babu Birbal, Curator of the Forest School, now sends in the following account of a somewhat similar occurrence in the School Gardens.

In April 1894 seeds of *Dendrocalamus strictus*, were collected on the Rajah of Nahan's estate at Kowlagurh in the Western Dun; they were sown in boxes in May and germinated well, a portion of the plants being put out in nurseries in the garden in October. These were dug up and planted out in the rains of 1896 but, the plants being rather large, some small side-shoots with pieces of rhizome attached were left standing in the nursery where they continued to grow. In April 1899, a few of

these plants flowered, and in June they produced a crop of healthy seed, some of which was sown and has since germinated. The flowering stems were from 3 to 5 feet high.

The part of the nursery on which the bamboos flowered happens to occupy the site of an old macadamized road and the soil is consequently somewhat poor. It is to this fact, combined with the mutilation of the plants, that Babu Birbal attributes their early flowering.

The distillation of Lemongrass Oil in Travancore.

The distillation of lemongrass oil in Travancore, unhampered as it is by taxes or fees of any kind, is one of the most important modern industries of the State. Lemon grass, *Andropogon citratus*, DC, in Tamil *chukku nari*, occurs all over the State except at the very highest elevations, but prefers open grass jungles in the plains and low moist valleys in the hills. Another species of grass called in Tamil *Shigun*, is also used but is not considered so good.

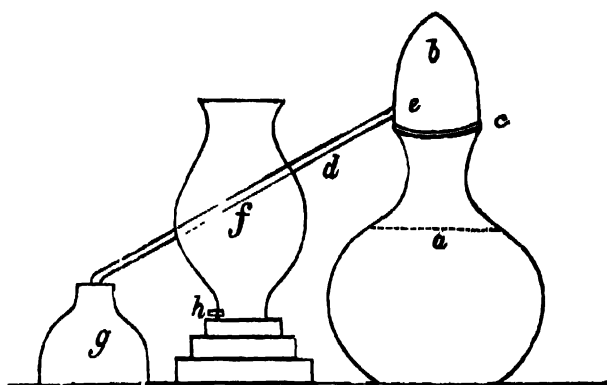
Two methods of distillation are practised, one in the Tamil or eastern part of the State, and the other in the Malayalam or western part near the sea coast.

THE TAMIL PROCESS.

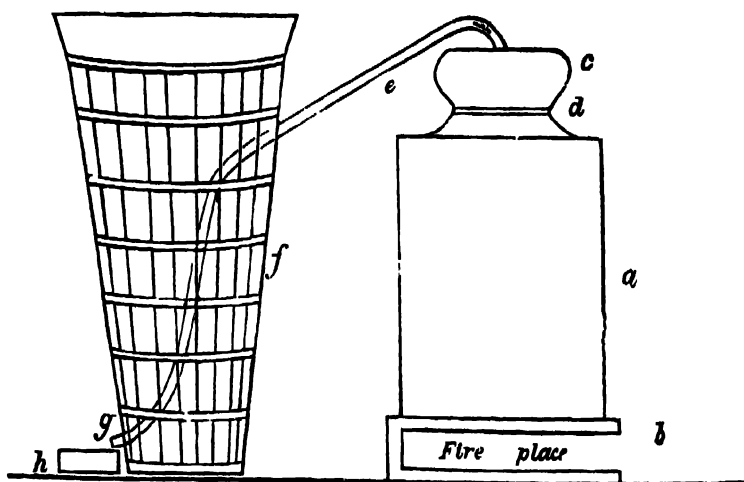
The grass is cut during the months of January and February just before the fire season commences. The tufts are cut close to the ground and the grass is chopped into pieces and dried in the sun for about 5 days. It is then put into a boiler *a*, usually made of copper and about 4 feet high. The boiler is filled to within a foot of the top and the grass pressed down tight, sufficient water being added to just cover the grass. The top is then covered with a specially prepared earthen vessel *b*, which communicates with a copper tube *d* about 3 inches in diameter, which passes through a condenser *f*, filled with cold water to the receiver *g*. The joints at *e* and *c* are made air-tight by luting with rags and clay. Fire is then applied all round the base of the boiler and as the water in the condenser becomes heated, it is drawn off through the plug *p* and fresh cold water added. Distillation is complete in 24 hours, about a pint of pure oil being obtained, and worth from 3 to 4 rupees.

THE MALAYALAM PROCESS.

On the western slopes, where the rainfall is greater, the grass reaches a height of from 5 to 7 feet and can be obtained sufficiently green and fresh for about 9 months in the year. The process of manufacture is practically the same as above, but the grass



THE TAMIL PROCESS.



THE MALAYALAM PROCESS

is not previously dried and the tops are rejected as useless. The boiler and condenser are also somewhat different; the former is made of copper with an earthen dome and the latter is a copper tube passing through a tall wooden bucket. Each boiling yields a quart of oil worth about Rs. 3 in the bazaar.

T. C. LEGGE.

The propagation of the common male Bamboo by cuttings in the Pinjaur-Patiala forest nurseries.

The following is one of the methods of propagating bamboos for covering the bare Siwalik hills in Patiala State, which has been tried with success :—

We selected sound and healthy male bamboo (*Dendrocalamus strictus*) culms, 3 to 5 years old, from healthy clumps of natural bamboo growing on hot and dry hills of from 2,000 to 2,500 feet elevation. These culms were divided into cuttings (what we term Puchhi) each cutting containing 2 nodes with parts of internodes at either end. These cuttings were planted between the 15th January and the 15th February 1896, in nursery beds and, as an experiment, the beds were prepared in two ways, to find out which would suit the purpose best.

- (a) Beds sunk in the ground so that they could be flooded with water to a depth of 3 inches and—
- (b) Beds with alternate ridges and trenches, the ridges being a foot-and-a-half wide and raised 9 inches above the level of the ground, and the trenches 9 inches deep and one foot wide.

The soil of the nurseries was composed of rich friable loam to which was added a large proportion of leaf mould and stable manure. The latter was specially added to give a certain amount of bottom heat and to cause the cuttings to strike readily. The cuttings in the level beds were put in standing upright with one-half buried in the ground, while those in the trenched beds were put in slanting, two-thirds being buried in the ridges in such a way that the lower end of the cuttings reached a little below the water level in the trenches.

The beds were flooded twice every week and by the middle of March the cuttings commenced to shoot, when the supply of water was moderated, but during the months of May and June (the hottest months) watering was continued every second day till the rains set in.

The cuttings all sent out 1 to 3 shoots, except a very few, about 5 per cent., which had been cut from the topmost part of the culms. During the first rains these shoots grew 3 feet in height, but were like whips bearing leaves.

The young plants were left undisturbed in the nurseries till next January (1897) when they were transplanted, with balls of earth, into bamboo baskets (gumlas) in which they were kept till the middle of July.

During this period the plants made very little progress, in fact some of the shoots died down, but they were replaced by new ones.

During the rains of 1897 the plants, with the baskets attached, were planted out at their permanent destination in the Siwaliks. They made good progress at first, but during the hot weather of 1898 about half of them died of draught.

SUNDER LAL PATHAK

Gum Kino.

The following notes on the collection of gum kino from *Pterocarpus marsupium* by departmental agency in the forests of North Malabar, are contributed by Forest Ranger A. R. Rama Rao.

The method of tapping the trees is as follows: incisions about one inch wide are made in the bark of the tree as shown in the accompanying wood cut, the vertical incision being about 6 feet long, and the side ones 9 inches long and 9 inches apart, and at the bottom of the cut is placed a bamboo tube to receive the gum. Only trees 6 feet in girth and above are allowed to be tapped and they may be only tapped on one side, unless they are over 8 feet in girth. It is proposed, however, in future to increase the length of the incision to 12 feet.

The gum begins to flow at once and is generally all run out in about 12 hours. The gum collected in the tubes is taken to the Range Office and poured into tins, which are then taken to Manantoddy and emptied through strainers into a wooden storing tank capable of holding about 80 cubic feet.

Drying the gum by artificial heat or by exposure to the sun was found to depreciate its value, and it is now carried out in a wooden shed with a corrugated iron roof. The shed contains 2 stands of wooden shelves closed in with muslin screens to prevent the access of dust, and on the shelves are placed shallow tin trays, each $2\frac{1}{2}$ feet long by 2 feet wide and about $\frac{1}{2}$ inch deep. The liquid gum is strained for a second time and poured into the trays to a depth of about $\frac{1}{4}$ inch. Drying lasts about a fortnight in the dry weather and 3 to 4 weeks in the rains. Each filling of the trays takes about 5 cubic feet of liquid gum which when dried gives 125 lbs. of kino. The trays can be filled 16 times in the year so the total amount turned out is 2,000 lbs a year. The dried gum is packed for export in lead-lined cases, each case containing 40 lbs. of gum.

The best time for tapping the trees is said to be from October to March when the trees are in flower, but the information on this point does not seem to be very definite. The tapping should be done late in the afternoon and the tubes removed early the following morning to avoid loss caused by the gum drying on the tree or in the tube. Gum can be obtained from trees of all sizes, but that from trees about 6 feet in girth is said to be the best. Trees of larger size give a smaller yield and the gum from smaller trees is lighter in weight, a fluid ounce of gum from trees below 3 feet in girth weighing 2·7 tolas, from trees 3 to 3½ feet 2·8 tolas from trees 3½ to 4 feet 3 tolas, from trees 4 to 4½ feet 3·1 tolas and from trees 5 feet and upwards in girth 3·2 tolas. A tree of 6 feet girth yields about 3lbs. weight of liquid gum or 1lb. of dry gum, and it is estimated that the trees might be tapped on alternate sides once in 5 years. The price of the gum which was 8 annas a pound in 1895, has now risen to Rs. 2 a lb. and there seems to be every prospect of a further rise.

The gum is generally collected by Kurumbors, the hill tribe of Malabar, who are paid according to the quantity supplied. They occasionally attempt to adulterate it with water, but the fraud can easily be detected, as if allowed to stand for a few days, the gum separates from the water. Adding water discolors the gum and destroys its keeping qualities.



VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

June 2nd, 1899.

EAST INDIAN TEAK—The deliveries for the first five months of this year amount to 8,508 loads, against 9,100 loads in the same months of 1898, and in May this year to 1,517 loads against 1,625 loads for May, 1898. Business in London during the month, both for timber and planks, has been of a retail and rather apathetic character. Forward business is small from lack of supplies, but what there is of it is at the highest quotations of the earlier months of the year.

ROSEWOOD,—**EAST INDIA**.—Continues in good demand and moderate arrivals find ready buyers at good prices.

SATINWOOD—**EAST INDIA**.—The demand is rather quiet and stocks sufficient.

EBONY,—**EAST INDIA**.—Is only occasionally asked for.

PRICE CURRENT.

Indian Teak per load	...	£11 15s	to £16 5s.
Rosewood	„ ton	9£	to £11
Satinwood	„ foot(superficial)	5d.	to 12d.
Ebony	„ ton	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST JUNE, 1899.

TEAK.—The landings in the London Docks during May consisted of 1,451 loads of logs and 221 loads of planks, totalling 1,672 loads; as against a delivery of 806 loads of logs and 527 loads of planks, or a consumption for the month of 1,333 loads.

The stocks in the Docks analyse as follows :—

7,228	loads of logs, as against	10,990	loads at the same date last year.			
3,056	„ planks	2,893	„	„	„	„
24	„ blocks	14	„	„	„	„
<hr/> 10,306 loads		„	13,887 loads	„	„	„

Notwithstanding the welcome addition to supplies during the month, the stock of logs is still some 25 per cent. under the moderate stock at the same date last year and prices continue very firm, although still below the parity of the present f. o. b. cost in India for first class timber. The stock of planks is ample, and although the demand continues good the present pretensions of shippers do not seem justified by current prices for parcels which have to be landed and stored ; and merchants and dealers on this side are therefore confining themselves to hand to mouth business as there is little temptation to commitments for stock at present c. i. f. prices.

Business during May although rather broken by the holidays was fairly good in volume, and prices were well maintained in all directions.

MARKET RATES OF PRODUCE.

Tropical Agriculturist.

June 1st, 1899.

Cardamoms	per lb.	2s. 9d.	to	3s.
Croton seeds	„ cwt.	55s.	to	70s.
Cutch	„ „	25s.	to	32s. 6d.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	7s.		
India rubber, Assam	„ lb.	2s. 9d.	to	3s. 3½d
„ Burma	„ „	2s. 9d.	to	3s. 2d.
Myrabolams, Madras	„ cwt.	6s.	to	6s. 6d.
„ Bombay	„ „	4s. 9d.	to	10s.
„ Jubbulpur	„ „	4s. 9d.	to	9s. 6d.
„ Bengal	„ „	4s. 6d.	to	7s.
Nux Vomica	„ „	8s.	to	10s.
Oil, Lemongrass	„ lb.	2½d.	to	2½d.
Sandalwood, Logs	„ ton	£30	to	£50.
„ Chips	„ „	£4	to	£8.
Sapanwood	„ „	£4	to	£5.
Seedlac	„ cwt.	55s.	to	60s.
Tamarind, Calcutta	„ „	15s.	to	16s.
„ Madras	„ „	10s.		

CORRIGENDUM

Indian Forester, July 1899.

Page 306, line 12, for "Modern" read "minor."

THE INDIAN FORESTER.

Vol. XXV.]

August, 1899.

[No. 8.

A method for introducing conifers into beech forest; its adaptability to the introduction of teak into bamboo forest.

In the course of a tour in the Black forest last year, I was much interested in the method very successfully adopted by Herr Oberförster Diesslin to introduce a mixture of firs in beech forest in the town forest of Schönan, a method which we Indian foresters would do well to keep in view in regard to the introduction of teak into bamboo forest.

The Schönan forest is situated on steep slopes with westerly and north-westerly aspects, between altitudes of 1,600 and 3,600 feet above sea level, draining into the Wiese (a river running southerly into the Rhine) on which lies the town of Schönan. Except quite the upper portion which is on gneiss with a gravelly soil, the whole of the area is on 'culm' a rock belonging to the lower coal measures giving a deep, moderately-stiff loam, an excellent forest soil.

The forest is composed largely of beech in the lower portion, beech with a sprinkling of silver fir in the middle portion, and of spruce and beech with some silver fir in the upper.

The problem to be solved was how to introduce the more valuable conifers in the portions where the beech largely predominates? Herr Diesslin has solved the problem in a masterly way. His procedure differs with the composition of the forest, but in both the principle is the same, namely, to keep the mass of the beech forest in full canopy, while portions of it are treated here and there.

There are two procedures : (1) where there is already a sprinkling of conifers in the crop, and (2) where it is composed of pure or almost pure beech.

(1) In portions of the forest containing a fair sprinkling of conifers mixed with the beech, several beech trees are cut out round each conifer, the rest of the beech forest being kept dark. The result is usually a good crop of conifer seedlings round

each tree treated. When these have established themselves, the clearing is somewhat enlarged and a new crop of conifer seedlings results, more or less mixed with beech which is kept within bounds by weeding. By this means groups of silver fir and spruce are obtained at various points in the wood where formerly there were only individual trees. If there are sufficient of such points of regeneration, nothing more is required than to regenerate the intervals naturally with beech and finally plant blanks with spruce.

(2) Where the crop is pure beech, or nearly so, the procedure is to clear spaces of about $\frac{1}{2}$ acre here and there in the wood, leaving the rest dark, and to plant up these spaces with spruce. As soon as the plants are well established the spaces are extended by clearing all round perhaps another $\frac{1}{2}$ acre, and planting up and this may be repeated a third time. Beech plants which introduce themselves have to be kept down by weeding. When the planted spaces are sufficiently large the rest of the wood is naturally regenerated with beech, as in the first case. The result of both procedures is the creation of a number of islands of conifers in the sea of beech. Regeneration of the wood by this method takes a comparatively short time, *i. e.*, from 20 to 25 years. It may be mentioned that Herr Diesslin believes in letting in a good lot of light round the conifers in order to bring the soil into a fit condition for germination, *i. e.*, with a thin covering of grass over it, he is thus enabled to cut away the beech freely round the conifer seed bearers, thereby reducing the beech regeneration and hastening the result in view.

It appears to me that both procedures are practicable for the introduction of teak into bamboo forest in Burma and India where teak can be profitably grown. The first procedure would be carried out by cutting out bamboos round teak seed-bearers, but it will be necessary to lop and heap the debris of the culms over the stumps and thoroughly burn them in order to kill the roots of the bamboo, otherwise fresh shoots will appear, which will rapidly increase in size and soon again cover the ground. It will also be advisable, in order not to lose time, to dibble in teak seed at 5ft. by 5ft. in the clearing. The cost of clearing and subsequent weeding would, no doubt, be considerable; and with our present large divisions in Burma, the operation could, I think, be extended over an area of more than 200 acres a year in each division, but the resulting gain to the forest would, I think, be well worth the expense and trouble.

The second procedure is somewhat analogous to our taungya plantations in Burma and we cannot have a better method of introducing teak where it is absent, or nearly so. But the clearings can be made somewhat larger in bamboo forest than they can in beech as there is not so much fear of the effects

of wind. There are large areas of bamboo forest in Burma and India where teak can be profitably grown, and it would be a good thing to draw up, in consultation with the taungya cutters, a rough plan for making taungyas in each forest. I notice in para. 57 of the Annual Report of the Pegu Circle for 1897-98 it is stated that "the task of weeding taungya plantations has grown most burdensome." It has no doubt increased inconveniently of late years in that circle, but this is partly owing to the system that has been in vogue of weeding each plantation every other year and continuing these weedings till long after they were really necessary or useful. With a rational system of weeding, i.e., thorough weeding for the first 2 or 3 years after the plantation is taken over, and an occasional weeding afterwards, I do not think anything would be required after the age of 8 years, except to cut out bamboos at gradually lengthening intervals. It is of great importance to encourage the growth in plantations of teak of an understory of other species to cover the ground. This object is defeated by the system of frequent weedings carried on till too late an age. I saw many plantations in Pegu where the frequent weedings have almost exterminated the accessory species, and very little is left under the teak except grass and useless weeds. The establishment of an understory and its subsequent control is not an easy business, but it is an important matter and I do not think it has hitherto received the attention which it deserves.

The results of the latest attempts to introduce teak into bamboo-flowered forest as reported in para. 58 of the Pegu Report, are quite what I expected, and show that very little good can be done by general sowings in such forest. I believe that the only rational way is to introduce it gradually by the methods above alluded to.

I am glad to see it stated in the Report that the 6ft. by 6ft. planting is recognised to be better than the 9ft. by 4ft. No doubt it is. You get more regular plants and suppress the weeds sooner.

F. B. DICKINSON.

One of Nature's Coppices.

In the north-east corner of the North-West Provinces in the Pilibhit district, and about 20 miles from the base of the Himalya, there is a nearly pure sâl (*Shorea robusta*) reserved forest covering 150 square miles which, on examination, will be found to consist almost entirely of coppice shoots. This natural

coppice is chiefly due to the physical properties of the rock (geologically speaking). Well-sinkings show that this is a light, porous sand of a moderate depth only, followed by an impermeable stratum of clay, so that water lies at but a short distance below the surface of the ground, usually from 10 to 20 feet. The sand being so porous and water so close to the surface, night radiation is excessive. The consequences are, severe frosts in the cold season and cool nights in the hot. December, January and February are the coldest months, their mean temperature being 60°. At this season night frosts are not unfrequent, as much as 10° of frost being occasionally registered. After such a frost the forest has all the appearance of having been the scene of a jungle fire. All leaves exposed to radiation up to a height of 10 to 15 feet have been shrivelled up and browned. Some sâl trees 50 feet high in exposed situations occasionally have every leaf killed. Young coppice shoots and seedlings, not above the frost level, are for the most part killed down to the ground and all the tender lower shoots of the year on the older trees are also killed.

Sâl is a gregarious tree, attaining under ordinary circumstances, a height of 90 feet and a girth of 6 to 8 feet. It belongs to the tropical family of *Dipterocarpaceæ* and is its most northerly representative; hence its great sensitiveness to cold. To thrive, it demands a well-drained soil and we find magnificent forests of it 20 miles to the north of Pilibhit along the foot of the Himalaya in the Kumaun Bháhar, where the soil consists of vast deposits of sandy silt of great depth mixed with boulders from the mountains, through which water percolates freely.

In Pilibhit the sâl is outside its favourite habitat, existing as it were on sufferance, and it is only owing to its great coppicing powers that the species has succeeded in maintaining its ground. The whole forest looks dwarfed and composed of pigmy trees. Sâl of corresponding girths are only one-third or one-fourth the height of the Kumaun trees and their flattened crowns indicate that their upward growth has been arrested. The inferior quality of these trees is further shown by their contorted stems, sâl under favourable circumstances growing as straight as the larch. A considerable quantity of grass is scattered throughout the forest and the sâl leaves all fall in February and March, so that when the jungle fires occur from March to June, the dry grass and leaves furnish material in abundance for feeding the flames. These fires kill down to the ground nearly all the young seedlings and even saplings. The saplings which are not killed have their leading shoots destroyed and this too is the fate of the tender young shoots of the larger trees.

The rains begin towards the end of June and last until the end of September. During this period coppice shoots are sent

up from the stools of the seedlings and saplings which have been burnt. Some new seedlings spring up from the *sâl* seed which is shed at the beginning of the rains. Many of these rot in the water-logged depressions and others survive to be killed down to the ground later on by frost or fire. On the higher ground the *sâl* coppice shoots which spring up annually get stronger and stronger as their underground stems increase in size and can supply them with more nourishment, until they reach above the ordinary frost limit, or their numbers, by killing out the grass, reduce the violence of the annual fires. They then survive these two enemies, especially when favored by one or two mild winters or a wet hot season or two when the forest escapes being burnt, and gradually form into the dwarf-like trees, of which the forest is mainly composed.

One of the most characteristic features of the jungle are the large savannahs filled with grass and coppice-shoots of *sâl* which are killed down yearly and never grow up into saplings. These savannahs resemble large islands of grass in the midst of the surrounding forest. Many of them cover hundreds of acres and are such a feature of the jungle that the natives give them a special name, '*chandars*.' These *chandars* are usually situated in slight depressions, so slight indeed as to be often imperceptible to the eye and only to be detected by levelling. The ground is thus more or less water-logged during the rains, the fires are fiercer in the hot season owing to the quantity of grass, and the frosts severer during the cold weather from the absence of high cover.

Thus water, frost and fires combine to prevent the *sâl* from growing up and forming a forest. The unfortunate tree has hardly a minute's breathing time, contending against frost from December to February, against fire from March to June, and against swamps from July to September. To cap all these ills there are numerous village cattle (about one to the acre) which graze in the forests all the year round. Luckily they do not eat *sâl* but they seriously injure reproduction by treading down seedlings and young coppice shoots. It is thus only owing to its marvellous coppicing powers that the *sâl* has been able to maintain itself above ground in the shape of annual coppice shoots. If we dig up one of these young shoots we find it proceeds from a curious large gnarled underground stem of great age.

The Topla forest in the Balaghat district of the Central Provinces is a further striking example of the difficult struggle for existence which the *sâl* has to maintain in a region of frost. Topla is one of the high plateaux so characteristic of these provinces, its altitude being from 2,000 to 2,500 feet. Frosts are often severe from December to February, and their effects on the vegetation up the principal valleys are most marked. Thus, bordering the streams themselves, along the low lying, occasionally swampy ground, we find belts of grass followed by belts of low

sâl coppice shoots precisely similar to the 'chandars' of Pilibhit. The 'chandars' are in their turn succeeded by a belt which resembles a hop-garden in Kent more than anything else. The trees here are mostly saplings and fairly straight. Their lateral branches, however, seem to be killed off close to the trunk by frost but shoot out again yearly so that each trunk is covered with thick clusters of small branches all the way up. Many of the tops are also killed by frost. Finally, on the higher ground where the frost is much less severe, the hop zone is succeeded by true high forest.

In the 'chandars' and perhaps to a less extent in Topla, a curious feature in the flora is the number of dwarf species. The chief points to be noticed in these species are the enormous development of their underground stems or rhizomes, their close relation to the tree species of various families growing in the same district in more favourable localities, and their flowering in the hot season usually after the annual fires have run through the forest. In fact they are all examples of annual coppicing by nature, the underground stems only being perennial, sending up shoots yearly after the fires. The following are the most noteworthy of these dwarf species, parts of the description being taken from Brandis and Hooker.

Grewia sapida and *Grewia scabrophylla*.—The *Grewias* are mostly trees and shrubs and belong to the Tiliaceæ. The species are very numerous and difficult to define, as they are so variable and their characters tend to run into each other. Being so changeable it is easy to imagine one or more species of this genus accommodating themselves to frost and fires and thus gradually evolving new species. Our two dwarf species are small under-shrubs, with short, thick, woody, underground stems which throw up annually a number of herbaceous shoots seldom more than a few feet high. These, after bearing leaves, flowers and fruit are generally burnt down by the jungle fires of the hot season. Their fruit is an edible drupe, the seed being enclosed in a hard stone, which prevents its destruction by the fires. There are also at least three species of tree *Grewias* found in Pilibhit.

Ochna pumila occurs chiefly in sâl tracts. It has a perennial underground stem, throwing up annually, after the jungle fires, a number of sub-herbaceous stems up to 2 feet high, bearing flowers in April and May. It much resembles *Ochna squarrosa*, a small tree occurring a little further east in Bengal where *O. pumila* is also found.

Olar nana is another of those odd dwarf plants which, like the preceding, appear never to form a trunk but only a contracted stock from which the shoots originate every year and are destroyed by fire, frost, cattle, etc. *Olar scandens*, a stout climber, occurs in neighbouring forests, whilst the half-dozen remaining species found in India are all trees.

Erythrina resupinata belongs to the *Leguminosæ*. From its thick, perennial, underground root-stock there springs up in March and April short racemes of large, bright, scarlet flowers, resembling those of their near relation *E. suberosa* the Indian Coral tree, which occurs in the same forest. The flowers seem to spring out of the ground like a ground orchid and it is only after flowering that the short, herbaceous, heavy stem appears.

Combretum nanum is a decumbent, low shrub with a thick, woody, prostrate stem. It is a good instance of those dwarf plants which have so well accommodated themselves to their surroundings and is burnt down annually by the forest fires. It forms a regular fringe to the sâl forest besides appearing in the 'chandars'. It is in this fringe that the heaviest grazing occurs and *C. nanum* withstands cattle even better than the sâl does. Nearly 20 species of *Combretum* occur in India, most of them being large shrubs.

Careya herbacea is annually burnt down. The root-stock is perennial and woody and the leafy flowering shoots about half-a-foot long. The large, beautiful pink flowers and big green globose fruit, 3 inches across, closely resemble those of *Careya arborea*, a large tree found in the neighbouring high forest.

Premna herbacea has a similar woody, perennial underground stem. There are over 30 species of *Premna* in India and all of them are trees or shrubs except *P. herbacea* and *P. macrophylla* which takes the place of the former in Burma.

Euphorbia fusiformis has an underground stem exactly like a large carrot and bears on the top, after the jungle fires have cleared the ground, a small tuft of flowering stems, only an inch or two high. It would be impossible for this species to exist in its present form were it not for the jungle fires, as its small tuft of flowers would be completely smothered in the long herbage.

Phoenix acaulis.—A dwarf palm found scattered throughout the 'chandars' and in other portions of the forest most exposed to fire and frost.

The above are the most conspicuous examples of dwarf species occurring in the Pilibhit and Topla forests, but the list is by no means an exhaustive one. Is it not possible that they have been gradually evolved from allied tree species which, owing to an unfavourable combination of climatic causes, have been unable to maintain themselves in their original form?

N. HEARLE.

Mr. Nisbet's note on Improvement fellings for the benefit of Teak in Burma.

In Mr. Nisbet's note on Improvement fellings he says that the whole of his suggestions are based on the understanding that such improvement operations shall only take place in areas protected from fire. Before, therefore, proceeding to discuss his suggestions, it will be as well to enquire what is the extent of the fire-protected forests and what proportion they bear to the whole area of reserves.

The last published Annual Report (1897-98) gives the following figures :—

Circle.	Total area of reserves. Square miles.	Area attempted to be protected. Square miles.	Cost per square mile. Rs.	Proportion of area attempted to be protected to total area.
Tenasserim	4,137	562	43	13%
Pegu	3,236	502	53	15%
Eastern	2,658	428	20	16%
Western	4,676	488	13	10%
Total	14,707	1,980	31	13%

That is, there are still some 12,720 square miles of reserves in regard to which no attempt has been made to exclude fire; and matters are really not so favourable as would appear from these figures, for there is strong reason to believe that, with the exception of some comparatively small areas, the forests shown as fire-protected in Upper Burma are not protected by any special means and only escape burning so long as there are no accidents and the people in the vicinity obey the rules in regard to firing forests; consequently the area for which adequate means of protection are provided may be taken as being nearer 8 than 13 per cent of the whole. Under these circumstances it appears to me that Mr. Nisbet's proposals, even if otherwise desirable, are decidedly premature, and that the first duty of the Burma Forest Department is to increase its area of fire-protection.

But to return to the subject of improvement fellings. Experimental operations of this kind have been carried out in Burma at intervals for the last 30 years or so, and the experience so far gained, both in this respect and the cognate matters of teak taungyas and the treatment of flowered bamboo areas, was recorded in various notes printed in 1893.* I shall therefore only deal with the subject very briefly.

*Works of Improvement, by G. Q. Corbett.
Taungya Plantations, by P. J. Carter,
Regeneration of teak in areas of flowered bamboo, by P. J. Carter
and J. W. Oliver.

For the purpose of this discussion the teak-producing forests of Burma may be divided into three classes :—

- (1) Mixed deciduous forests without bamboo undergrowth.
- (2) Mixed deciduous forests with a more or less dense undergrowth of bamboos.
- (3) Evergreen forests.

In the first of these, improvement fellings, whether in the form of seed-fellings or fellings for the purpose of giving room to existing seedlings and young trees, can be made with the greatest advantage. The older teak dibblings in the Kangyi reserve mentioned in para 58 of the Pegu Circle Conservator's report for 1897-98 are a good example of this kind of work, though it is a mistake to suppose that they have never been weeded. This class of forest is, however, very limited in extent, and forms but a trifling proportion of the total area of reserves.

In deciduous forests with bamboos, which form the main bulk of the reserves, improvement fellings (of trees) are as a rule of but little value unless carried out, either immediately before or within a few years after the flowering of bamboos. At other times the benefit caused by the removal of trees from the upper story is mainly monopolized by the bamboos, which are thereby induced to grow all the more rampantly, and little advantage accrues to the teak plants, unless they happen to have their heads above the bamboos. Moreover, the removal of the trees often takes away the side support from the bamboos and causes them to fall over, bringing with them any dominating teak saplings and more effectually suppressing the seedlings beneath them. Cutting back the bamboos themselves is only effective when the operation can be repeated every year, or at very frequent intervals, until either the bamboos flower and die or the teak poles grow beyond the reach of the bamboos. If carried out in this way the results are very good, but the operation is rather a costly one and could not be carried out on the scale proposed by Mr. Nisbet. Successful clearances of patches of bamboo jungle combined with teak sowings have also been made, but their cost has proved prohibitive. On areas over which bamboos have flowered and teak reproduction has taken place, improvement felling may be decidedly beneficial, but the number of trees which should be removed is small as the tree cover is, as a rule, very light, and it is for various reasons better in such cases to wait until teak reproduction is assured than to carry out the fellings in advance.

I do not here propose going into the question of the treatment of forests when a general flowering of bamboos takes place, but would merely remark that, as a rule, when there is a sufficiency of teak seed-bearers, we shall not go far wrong if we leave the forest alone and let it turn every year until the dead

culms have been got rid of, as there is no doubt that the splendid reproduction of teak in parts of the Ruby Mines, Katha and Bhamo Divisions, have originated in this way, as well as that in the unprotected parts of the Bwet forest in Prome where the bamboo flowered in 1878.

Teak in evergreen forest occurs to a small extent in Tennasserim, and to a very large extent in the northern part of Upper Burma. The regeneration of teak in such forests is a problem which has not, as far as I know, as yet been solved. Improvement fellings seem indicated, but to be effective, their cost would be very heavy owing to the dense evergreen undergrowth which would have to be removed and kept down.

There is an inherent drawback to any system of improvement fellings on a large scale, which Mr. Nisbet appears to have overlooked. As he himself points out, all the more valuable hard-wooded trees can easily be killed by girdling, whereas the soft-wooded, useless kinds must either be felled outright or else repeatedly girdled. The former is expensive and often, for various reasons, inadvisable; the latter is impracticable, except in the case of operations on a small scale. The almost certain result, therefore, of improvement fellings carried out in the manner suggested by Mr. Nisbet, would be the ultimate extinction of most of the better class of trees other than teak, while the proportion of useless ones would remain undiminished, a result by no means desirable. Improvement felling is, in my opinion, a very delicate operation and should only be carried out under careful supervision. These remarks, of course, do not apply to climber-cutting, which is at all times useful.

There has lately been a reaction in Burma against taungya plantations, which have come in for a good deal of unmerited abuse. This is perhaps partly due to the fact that they have increased to such an extent that their up-keep has become burdensome and almost beyond the present resources of the department. The original idea of teak taungyas, as I always understood it, was to introduce on areas of old taungya cultivation, or in forest devoid of teak, a new growth which would mainly consist of groups of teak growing on the plots most suitable to that species, with mixed forest in between. It was, I think, never intended to establish groves of unmixed teak; for, although the whole area was usually sown or planted, it was considered that nature and the carelessness of the cultivators would ensure that the result would take the form of groups of teak. Gradually, however, Forest Officers became more exacting, and their endeavours to have the whole of the cultivated areas as well stocked as possible have added a good deal to the burden of weeding.

But, after all, the cost of weeding, cleaning or thinning plantations does not, as a rule, amount to more than Rs. 1/8 per acre, at each operation, which is what Mr. Nisbet would spend on his improvement fellings, and the burden is as nothing

compared to the latter. Surely, also, it is more profitable to spend Rs. 1-8 an acre on areas stocked with at least 600 plants to the acre, of which at least 60 may be expected to become marketable trees, than to spend the like on equal areas which do not contain more than 3 trees and seedlings to the acre on the whole, or 36 (including suppressed and unsound) to the acre in the very best localities.

Another charge brought against teak taungyas is that, valuable forest is often destroyed to make room for them. This, no doubt, has sometimes happened, but I think the damage has been exaggerated. As a rule the areas selected have been under ya cultivation some 15 to 30 years previously, and the forest cleared away consists mainly of bamboos and coppice poles, teak among others, with a few old trees, badly damaged by fire and half dead, and some seedlings, the latter mostly suppressed by the bamboos. The effect of clearing such an area is that the teak coppice poles and seedlings, which have been cut flush with the ground, start into vigorous growth, and a casual observer inspecting the ground would at once assume that valuable forest had been cut down, whereas, as a matter of fact, the trees removed may have been such as would never have grown into marketable timber. Mistakes have, I admit, been made, but I think in many cases the Range officer has been unjustly blamed.

It is quite probable that by this time most of the suitable areas in Lower Burma have been planted up, and a curtailment of taungya operations in that part of the province seems inevitable, but I would strongly deprecate a complete abandonment of the system, especially in Upper Burma. The taungya system properly carried out is admittedly the best and cheapest means of establishing plantations. It has been of immense benefit in Lower Burma in affording lucrative employment to the jungle people, thereby reconciling them to the restrictions of the forest rules, and in many cases enabling them to buy cattle and take to permanent cultivation in the plains, which alone is an enormous gain, as every taungya cutter the less means so much more forest saved to the country. It may at any time become expedient to introduce teak taungyas among the hill people in Upper Burma, and for this reason I consider it desirable that a small area should every year be cultivated in each division in order that local officers may become familiar with the system.

J. W. O.

22nd July 1899.

II.—CORRESPONDENCE,

Hours of Spring time.

In a delightful reminiscence of his days at Nancy, entitled "Hours of Spring time" M. Desjobert, retired Conservateur, describes many of the traditions of the *école forestière* in the *Revue des Eaux et Forêts* for July, which will be pleasant reading for every student of that revered institution. Writing of the years 1855-57, M. Desjobert prefaces his paper with :

"O vieux fagots de la trente-deuxième,
O vieux amis, qu'êtes-vous donc devenus ?
Depuis le temps que le destin vous sème.
En des chemins qui me sont inconnus ?"

and he writes of the practical excursions as follows.

"The soul of the school was truly in the excursions. The real instruction was what l'arade or Nanquette used to tell us face to face with a certain crop, or a certain working unit in the forest of Haguenau, for which we had to draw up a working plan in accordance perhaps with ideas which the first authority, even Nanquette himself, would not have afterwards endured. For, without an atom of false shame he used to say in after-life. "I was too young when I wrote these things, I would not write them now."

The life and soul of the school lay in the love of our profession, with which our masters imbued us by their daily contact with us when wandering about with us in the forests of Saverne and many others, of which I no longer remember the names. I can still picture to myself the admirable high forests of oak of Œuvre de Notre Dame—German to-day—which recal! the towers and spires of Strasburg's cathedral. And when one or other of the party talked of pruning those magnificent oaks, of removing this or that branch to regularize their appearance, "Never touch an oak, an old oak" said Nanquette with a shudder, and therein lies his résumé of the cultivation of oak. How many of those old oaks, such as we shall never again set eyes on, have I since seen ruined by being pruned with more or less care, close to the trunk or with long protruding arms, with and without coal tar, with or without subsequent cleaning off of new shoots!—Even under the pretext of raising the cover in a seed-felling never touch an oak. How are you to know that your reserved oaks, that you think of removing in 3 or 4 years, will not stand for 10 or 20 years, and then the wood around each wound will be lost, often rotten and always worm-eaten; and you can count yourself fortunate if the tree has not lost a third or a quarter of its value.

Do you remember the magnificent silver firs of the Vosges? It was very necessary to fell them one after the other. How their long stems, cleaned of their branches, balanced in space till the last cut of the saw, helped by a skillfully placed wedge, caused the giants to fall on the beds that had been prepared for them; what a crash their fall made, resounding through the echoes of the neighbourhood, and how we all, professors and students, looked on these grand spectacles with a kind of ecstasy! For it was these things, and the forests that our masters loved. *Nobis placent ante omnia sylve* said they. This love was their true strength, and they ingrained it in us, and thereby made men of the greater number of us.

I can still see Parade talking to us in thinnings which had been made in the previous winter, of his love for the under-wood, of the respect one should have for the old trees: and later, in I don't know what forest under conversion, Nanquette examining a felling in which under pretext of regularisation, they had felled the old oaks in order to reserve frail standards of the age in the poorest coppice—saying to me in a whisper that the guards might not hear “But such fellings are the abomination of desolation.”

Professional talk was the constant occupation of those days' work and fête, in which a joke or gentle humour had their place. In the evening professors and students were together at table, their appetites sharpened by the long walks and our twenty-year old jaws worked away boldly without thought of the future digestion. How many of us can enjoy the same now?

We started in the very early morning on foot or packed in straw in country vehicles. And by noon in a shady spot or by the side of a limpid spring, a squire of the neighbourhood, good friend of the forests and of the foresters, supplemented our modest repast with some toothsome galantines and old bottles from a good corner where they had been since Monsieur was a boy, said the footman.

I repeat it. These excursions in forests have remained in my memory—where so many things have been forgotten—as our veritable course of instruction, the soul of the school. Parade was the most suitable of all men for this kind of teaching. He was a man of character as well as of work, loving young men, knowing how to gain their confidence, inspiring them with love for their profession and instilling into them its sacred fire.

It is in this way that our masters have left their mark, and imprinted it upon us. These are the founders of the school who have formed the earlier generations, and through these have purified and regenerated the “Corps Forestier.” These are the men who have been the earliest pioneers of the schools' teaching, a teaching eminently French, since it is founded on order, economy and reverence for the past and has nothing of

the too often misty conceptions of our neighbours across the Rhine. Right on to these last years we have walked in the foot-prints of our illustrious predecessors: the traditions of the school have remained the same. May God so keep it always, and preserve us as long as possible from red tape and the exaggerations of administrative routine! The forester is made to live in the open air, to see, to act, to preserve and improve the legacies of the past: to write and spoil paper the least possible; but above all to dream lovingly of the hours of spring-time passed at Nancy, using his dreams as the happy magnet of his existence."

An admiring 'baliveau'

Notes on Sai Forests.

Under the above title a pamphlet by Mr. Eardley-Wilmot is printed with the June number of the Indian Forester. The author presented me with a copy some months ago, and this led me to pay more particular attention to the subject of *sâl* reproduction. I take this opportunity of recording a few observations on coppice growth of *sâl*.

The Charda forest in the Bahraich Division is a good example of a forest which has grown up principally from coppice shoots. Up to 1866 the forest was in the possession of the Rajah of Balrampur, and had been repeatedly cut over. Fire-protection was started in 1872, and closure to grazing in 1885, with a further extension in the same direction in 1895. Systematic fellings were first started in 1888, a system of coppice-fellings in strips being adopted. In 1890 this was altered to coppice with standards, and this method has been continued up to date under the present working plan, which came into force in 1895. The rotation is 20 years.

When examining the felled areas in May last, I devoted particular attention to two points; *viz.*, the limit of size of stools capable of producing coppice shoots freely, and the extent to which the reproduction was due to root-suckers. I propose to give a few notes on each of these matters.

Stools above 3 feet 6 inches in girth I found rarely produce shoots in abundance; stools of smaller size generally do so. I have seen shoots on stumps 4 feet in girth, but this is not common. Fellings in coupe IV were carried out from December to March last, and walking through the area towards the end of May, I rarely came across a stump less than 3 feet 6 inches in girth, around the edge of which shoots were not appearing. Larger stumps, more often than not, showed no signs of life.

As an example of difference in vitality I may give the following instance:—On 29th May I counted 115 clumps of shoots on a square chain of the area felled in February and March. This represented 1,150 to the acre only 2½ months after felling. A year hence the number will probably be much greater.

Twenty average clumps were dug up and measured as follows:—

No of clump.	Girth of cut stool.		Height of tallest shoots.		No. of shoots in the clump.	No. of clumps.	Girth of stool.		Height of tallest shoots.		No. of shoots in the clump.
	ft.	in.	ft.	in.			ft.	in.	ft.	in.	
1	4	6	0	8	10	11	1	2	4	3	9
2	4	0	0	6	3	12	1	0	4	8	4
3	3	5	2	0	1	13	1	0	1	9	1
4	3	2	4	3	13	14	0	11	2	11	10
5	2	2	3	5	10	15	0	9	2	8	5
6	2	0	2	9	4	16	0	9	2	3	5
7	1	8	2	3	6	17	0	8	3	4	4
8	1	8	3	0	6	18	0	8	1	5	4
9	1	3	3	10	9	19	0	6	2	10	2
10	1	2	4	3	6	20	0	6	1	9	6

The measurements were not sufficiently extended to serve as the basis of any argument, as to the comparative vitality of stools of different sizes. I merely record them with a view to showing how healthy and promising the forest is. A growth of 4 feet 8 inches in about 10 weeks compares favourably, I should say, with growth in any other forest.

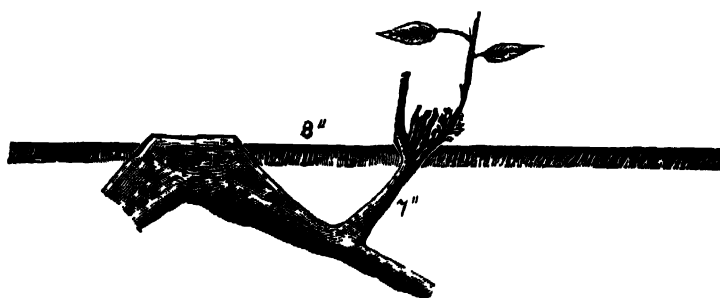
On the subject of root-suckers the author of the "Notes" states on page 9:—

"In tracing the root system of sâl coppice shoot, we will frequently find that root-suckers appear at long distances from the parent tree, and become practically independent so soon as they have established their own system of tap roots."

I have not found this to be the case in Charda. Root-suckers appear to be almost entirely absent. Having no experience of sâl forests in other divisions, I am not prepared to assert that sâl never produces root-suckers but it certainly appears to be the case in Charda. The roots of over 50 young trees were examined. Digging for a foot or so was sufficient to show, either that the shoots had sprung directly from cut stumps, or (in a few cases) that they were really of seedling origin. The shoots were chosen in last year's fellings, from those found growing at a distance from any standards, and apparently springing directly from the ground as straight single stems. No stumps were visible, but this

was due to the activity of white ants, and to the fact that trees are felled flush with the ground. Moreover, shoots from small stools have little or no curvature at the base, and when one takes the lead so quickly as to kill off its rivals at any early date, there is nothing on the surface to distinguish the young tree from a seedling or a root-sucker.

One solitary instance of what might be termed a root-sucker was found. Unfortunately I did not keep the specimen, but the following is a rough sketch.



At about 8 ft from the edge of a stump, 2 ft. 6 in. in girth, a weak shoot of the present year's growth was seen to spring from the ground, this was dug up and found to come from the side of a small club-shaped growth, arising at its lower end from a branch of the adjoining stool. The coupe in which I found this example was felled over last year. As the club-shaped growth below ground was certainly several years old, it must have originated several years before the tree was felled. It would be hardly safe to base any argument on the existence of root-suckers in general from this one specimen, I noticed it, and so mention the fact.

Study of the question of sál reproduction leads one to ask what is the difference between a seedling and a coppice shoot? In pages 3 to 8 of the Notes, Mr. Eardley-Wilmot describes in detail the struggle which almost every sál seedling has to go through. In all sál forests not more than one sapling in a thousand is a "maiden" tree, that is, a tree, of which the main stem has arisen from the continuous prolongation and growth of the primary shoot. In forests where natural reproduction from seed is in progress, as the author of the "Notes" points out, the young plant practically effaces itself, so far as upward growth is concerned, until the underground struggle has been decided in its favour, and even then, the question of light has to be considered before its future is assured. This is often a matter of several years. During all this time the first shoot does not persist—far from it. The primary shoot lives for a time, and through its leaves makes its small contribution to the food-store of the young

plant, and then dies or, may be, is broken, eaten or trampled under foot. Next season, an axillary bud develops into a shoot, lives for a time, and then probably shares the same fate. And so on, season after season, for possibly half-a-dozen years.

This can be particularly well seen where heavy fellings or thinnings have taken place. Here the axe decides the struggle for light at once in favour of the young plants and as a consequence they shoot ahead very rapidly. Removal of the dead leaves and soil from the base of a yearling shoot, 2 or even 3 feet high, has often shown that the shoot in question has sprung from a bunch of dead stalks on the head of a knotty root several inches in girth.

Such is the early history of an average seedling tree. What now takes place in a coppice forest such as Charja? This forest contains trees of all sizes from nothing up to 4ft. in girth. All but certain selected standards are felled flush with the ground in the annual coupes. In the case of small poles and younger trees there would appear to be little, if any, essential internal difference between the subsequent development of the coppice shoots from them, and of the seedlings above described. In the case of the latter, pre-existing shoots are removed by degrees by natural causes; in the case of the former they are removed artificially, all at once, with an axe. In both cases the root system is not fully developed at this turning point in the life of the plant. The coppice tree will shoot ahead of the "seedling" owing to its having the advantage of a start in root-growth, but after 20 years or so the difference in height-growth will begin to diminish. That the "seedling" should ever overtop its rival, or produce more fertile seed, on a *priori* grounds, I fail to see. Turning now to shoots from large stools one cannot but admit that there is a different set of conditions. The root-system of a stool 3 ft. in girth is probably some 40 to 50 years old and already fully developed. In the small stump a certain amount of decay from the cut surface will take place, but it is a question if, under ordinary circumstances, this will proceed right into the heart of the main root. On the other hand it is the exception, rather than the rule, to find that the root-system from a large stool does not quickly become thoroughly decayed. This represents a corresponding reduction in vitality, and so it may well be that the coppice trees from such a source are incapable of producing fertile seed to any great extent. On this head further investigation is required, as Mr. Eardley-Wilmot pointed out to me at the beginning of the present year.

In the light of the above remarks, I would answer the question with which I began the last paragraph, by stating that a hard-and-fast line cannot be drawn between seedling and coppice growth of sal, as we know it in our Indian forests, and that, for all practical purposes, part of the reproduction in coppice fellings such as Charja (say from stools under 1 ft. 6 ins. in girth), should

be looked upon as similar in all respects to the bulk of the reproduction in forests worked under a system of selection fellings, including such preliminary operations as improvement fellings, as the greater part of the timber forests in Oudh are. If this idea is correct, and bearing in mind that in such a forest as Charda a certain number of seedlings (in the ordinary sense of the term), are appearing year after year, there should be no fear of not having, in subsequent rotations, a sufficient number of what I may call "seedling-coppice trees" to produce fertile seed for the replacement of older stools by younger ones. By seedling-coppice trees I mean coppice from small stools, say under 1 ft. 6 ins. in girth.

BAHRAIOH ;

F. A. LEETE.

28th July, 1899.

III.—OFFICIAL PAPERS & INTELLIGENCE.

The botanical sources of Padauk.

We reprint below an interesting letter from Major D. Prain, I. M. S., Director of the Botanical Survey of India, to the Inspector-General of Forests in regard to the botanical sources of Padauk. As far as our own observation goes, the Padauk of the dry forests of Upper Burma agrees with that described by Kurz as *D. macrocarpus*.

"I shall be glad to render you all the assistance that I can in connection with your enquiry into the actual botanical source or sources of Padauk.

"I am aware that it is generally believed that Padauk is derived from the species known as *Pterocarpus indicus*, Willd., and that this species is believed to include not only the tree which yields the Padauk of Burma, but that which yields the Andamans Red-wood. I have already had occasion to publish my reasons for believing that the tree which yields the Andamans Red-wood is entitled to be considered, as Dr. Roxburgh originally considered it, a distinct species, *Pterocarpus dalbergioides*; but I have further been led to suspect that the Padauk of Burma is not altogether or even chiefly obtained from *Pterocarpus indicus*. My reasons for this belief are: (1) that no wood quite corresponding to the best Padauk is, so far as I can learn, exported from the Malay Peninsula or Archipelago, where *Pterocarpus indicus* is a common tree, and (2) that *Pterocarpus indicus* is not a common tree in Burma. It is indeed fairly common, to judge from our material here, as a wild tree in Tenasserim, but I do not believe that it is to be found in Burma north of Tenasserim, except as a planted tree

near Rangoon and other large centres of population. We have indeed some specimens named "Padauk bin" from Burma that are undoubtedly *Pterocarpus indicus*; but by far the greater number of our specimens of "Padauk" belong to the very distinct species *Pterocarpus macrocarpus*. If the specimens that you are now asking for are carefully collected by your officers, they will help to clear up what is an interesting scientific, as well as an interesting economic question."

In this connection I ought to point out to you that *Pterocarpus indicus* is said, in botanical works, to occur in India as well as in Burma. So far as my knowledge, derived from specimens, goes, I am inclined to doubt this. My only specimens from India of *Pterocarpus indicus*, the tree of Malaya and Tenasserim, or of *Pterocarpus dalbergioides*, the Andamans Red-wood tree, are from places in which these trees must almost certainly have been planted. The Indian tree that appears to have been mistaken for Padauk is the one that was known formerly as *Pterocarpus Wallichii*, and I believe it to be much more nearly allied to *Pterocarpus marsupium* than it is to *Pterocarpus indicus*. If it would not give you too great trouble to do so, I should esteem it a favour if you asked all Forest Officers in India, as well as in Burma, to send specimens of the species of *Pterocarpus* growing in their forests. It would thus be possible for us to make our review, both from the economic and the scientific points of view, of the genus complete and add greatly to its interest and its value."

Injurious Insects of Indian Forests.

In forwarding for circulation among all Forest Officers who may be interested in the subject and who may be willing to co-operate in the collection of specimens and data, copies of a pamphlet on "Injurious Insects of Indian Forests" by Mr. E. P. Stebbing, Assistant Conservator of Forests, Bengal, the Inspector-General of Forests makes the following remark.

Mr. Stebbing's object in writing this pamphlet is to obtain the assistance of his brother officers in collecting further information concerning our forest insect-pests, about whose operations and life-histories, so little is at present known.

The pamphlet purports to contain most of what is at present known of Indian injurious forest insects, the information being compiled chiefly from reports sent in by Forest Officers at various times. It will be noticed that this information is often of the most fragmentary description, so much so in fact, that very often it has been impossible to name the insect, whose attacks have been reported, from the scanty specimens and details sent

in. All such reports, however, have been scrupulously entered in the work, as Mr. Stebbing hopes that, attention being thus drawn to the matter, officers will endeavour to collect good sets of specimens and to make themselves acquainted with the life-histories of the pests. Such specimens, with the notes on the life-history of the insect, should be forwarded to Mr. Stebbing, who has undertaken to identify and describe, or get identified and described, insects forwarded to him.

Mr. Stebbing only requires insects that have been ascertained to do actual damage in our Indian forests.

The author of the pamphlet states, and the fact will be apparent from a perusal of the work itself, that it is generally a waste of time to forward larvæ or pupæ alone—their identification can never be carried very far, and it leads to an accumulation of practically useless information. The pamphlet gives many allusions to undetermined larvæ of families which have been forwarded with reports, that they have appeared attacking such and such trees. Such reports are at best of very little use. Mr. Stebbing points out that it is well known that numberless *Curculionid* larvæ, *Longicorn* larvæ, etc., etc., attack wood, and the mere fact of sending specimens of such larvæ does not tend in any way to increase our knowledge of the life-histories of species of these families, as they cannot be identified from such fragmentary data.

Mr. Stebbing has furnished the following notes on the collection of specimens of insects and the record of their life-history—

I. *Collection of specimens.*—

When bad attacks of an insect are noticed in a forest, some specimens of the pests should be put into a bottle of spirits of wine or formaline. The particular tree, or area of trees, should be then carefully watched and, as soon as the larvæ commence to change into the pupæ state, specimens of such pupæ should be obtained, and may also be put into the bottle. A further watch will be rewarded by the appearance of the imago, and of these a number of species should be obtained, so as to ensure, if possible, both sexes being represented amongst the specimens collected. The imagos should not be put into the bottle but may be sent either pinned in a box or placed in saw-dust, with a piece of camphor; or, better still, with a little benzine sprinkled over them. Should the destruction be accomplished by the perfect insect (imago), specimens of the egg, larvæ, and pupæ, with dates of emergence, should be also furnished.

II. *The Life-histories of species collected.*—On the appearance of an insect attack, the following notes should be made:—

- (i) Date of appearance. Under this head it is *extremely important* that the dates of appearance and length of time passed in the different stages should be given for—

(a) Egg stage	...	From [here give date of laying eggs]	
		to [here give date of emergence of larvæ].	
(b) Larvæ stage	...	ditto	ditto of changed into pupæ,
(c) Pupæ stage	...	ditto	ditto do, into imago.
(d) Imago stage	...	ditto	ditto

It may be mentioned that many wood-boring larvæ often spend several years in the larvæ state boring up and down the tree. Endeavours should be made to discover the exact length of time passed in this period in these cases. Similarly, a long time may be spent in the pupæ stage. In some cases imagos lie dormant during the winter cold and only proceed to lay their eggs when the warmth of spring re-awakens them into activity again. More important still is the fact that many destructive species have *several broods during the year*. In such cases it is exceedingly important to discover and note the number of broods passed through by any species during the year, with dates of appearance and damage done, etc., etc. Without such information it is useless endeavouring to counteract such attacks.

(ii) Locality where found, with elevation above sea-level, character of forest-growth, and any other information of interest.

(iii) Tree attacked and nature of attack, whether defoliating, boring, etc.

Too much stress cannot be laid on the importance of sending, in all cases, dates of appearance of the various stages, with the locality and elevation above sea-level.

Besides the collection of specimens and information about insects that are obviously causing wide-spread damage in a forest, Mr. Stebbing points out that numberless members of the great Coleopterus families, Bostrychidæ, Curculionidæ, Logicornidæ are continually at work in our forests and yet the present available information as to their habits is very scanty. It is proposed that officers should have cut, here and there in their forests during the cold weather, a *perfectly sound and vigorous tree*. This should be left lying unbarked in the forest and periodical visits should be paid to it. Wood-boring insects will very soon make their appearance and their habits can be ascertained and in this way it is considered that a large amount of information on the life-histories of forest insect-pests may be obtained. In reporting attacks of boring insects the position of the tree, whether standing erect or lying felled in the forest, should be always mentioned.

For further hints on collecting and forwarding insects, attention is drawn to the memorandum on killing, preserving and transporting insects, by Mr. M. E. Clifford, which accompanied the Government of India's Circular No. 2-F., dated the 16th February 1888.

IV.—REVIEWS.

Forest Administration in the Northern and Central Circles of Bombay during 1897-98.

Northern Circle.—The returns show the area of the Government forests in the Northern Circle at the close of the year to be 2,802 square miles. There was during the year a small decrease of about 2 square miles: but the area will "probably" greatly decrease during the current year as certain reserves, the Madasa forests and others, are being handed over to the Revenue authorities under Government Resolution No. 7284 dated the 4th October 1897. We have not seen a copy of this resolution and can, therefore, give no further particulars; but from the wording of the paragraph in the Annual Report it would appear that these forests, the area of which is not given, are in future merely to be placed "in charge of the Collector of Ahmedabad and Commissioner, Northern Division." It would be interesting to obtain further particulars as to the grounds for this procedure. The small decrease in area is due entirely to forest settlements, which are in progress in most of the divisions, and apparently a great deal still remains to be done. As in many other parts of India the incorrectness of the old village maps is giving considerable amount of trouble and causing delays; but in a country under ryotwari settlement the difficulty must be reduced to a minimum. Another cause of delay in the completion of the settlement operations must surely be attributed to the frequent change of officers. During the year no less than three changes occurred in the Thana Settlement Office. This is a matter which the Forest Department itself might do well to attend to, for there can be little doubt that many of the difficulties in Bombay, and the general want of progress must in a great measure be due to the frequent changes of officers. To give but a few examples, we note that the South Thana Division during the year had 4 Divisional Officers; Surat 3 Divisional Officers, but 4 changes; Belgaum and Dharwar each five changes of Divisional Officers and so forth.

The very necessary work of demarcation appears to be progressing fairly satisfactorily: but a very great deal still remains to be done. Two hundred and fifty-six miles of boundary were demarcated, and 5,588 cairns were erected at a total cost of Rs. 3,328. In the Northern Circle the boundaries appear to consist of cleared lines, 15 feet wide, with small stone cairns erected at such distances apart as to be easily visible one from the next. In North Thana the width of the cleared

boundary lines is being reduced from 20 feet to 15 feet ; but whether this is a sound measure in view of the many cases of trespass and unauthorized grazing, must remain an open question.

In North Thana experimental attempts were made to mould a special boundary mark from sand, broken stone and cement mixed with water in an iron mould, but the results were not very successful. This form of work has, it is believed, proved useful near Darjeeling, and we shall be glad to publish any particulars the Forest Officer, Darjeeling, may be able to supply regarding the precise method of their construction, especially as we note that further attempts to produce a serviceable mark are to be made in North Thana.

A Forest Survey party was at work in the forests of the Northern Circle, and during the year completed 54 square miles of "detail survey" at a total cost of Rs. 9,666. The scale adopted for the Bombay surveys appears to be 8 inches to the mile, a very large scale, and it is doubtful whether the slightly greater accuracy obtained justifies the large expense incurred. On the other hand, the large scale maps should render the preparation of working plans on a coppice system a matter of comparative ease. And this is a matter of urgent necessity. At the close of the year only 27 per cent (638 square miles), of the total area of the circle had been brought under the provisions of regular working plans. Work, however, appears to be progressing satisfactorily, as no less than 260 square miles were taken in hand during the year, and of these 112 square miles were finally disposed of. The method of coppice with standards adopted for the working of the Bombay forests appears to entail an enormous amount of work in the working out of the annual coupes. During the year no less than 262 coupes had to be marked out, entailing the erection of 730 cairns and 24,678 subsidiary stones. And the whole of this work is of a very temporary nature. A move in the right direction is, however, being made in the Panch Mahals, where a number of coupes were "permanently marked out on the ground by cut stones planted at the main angles ; these stones are somewhat expensive and difficult to obtain, so that other marks may have to be devised, but the work must be pushed forward with as little delay as possible, otherwise there is danger of the temporary marks being washed away, and the employment of surveyors to pick up points again becoming necessary."

With what justification we cannot say ; but there undoubtedly exists a feeling among a majority of the Bombay officers that certain matters which might rightly be considered to come within the province of a forest officer, are being unnecessarily handed over to the Revenue authorities. It is with astonishment, therefore, that we read of forest officers occupying the whole of their time in carrying out valuation work in *occupied lands*, and this to the absolute detriment of their legitimate duties as trained forest officers in charge of forests, whose

future should be a matter of some importance. Thus, it appears that such important and necessary works as the selection and making of standards, the up-keep of records of yield, and even the inspection of the forests had to be abandoned, whilst the officers were engaged in the valuation of teak trees growing in occupied lands, a work which might well be undertaken by the Revenue authorities, as long as the Forest Department remains undermanned. In this respect we cannot do better than quote the words of Mr. Lely, I. C. S., Commissioner, Northern Division, in his forwarding memo. as his remarks, being quite unbiased, should carry some weight. He writes: "In the Thana district a special burden has been imposed on the department in the valuation of teak trees in occupied lands for sale to the occupants. Mr. Fry estimates that this encumbrance will not be got rid of for seven years. Meanwhile, in the absence of the extra establishment which has been asked, most important works are hampered or obstructed altogether, such as the record of annual yield, the efficient protection of the forests and the correct selection and working of standards in the coupe. This seems a pity."

The question appears to be one of such urgency that we trust steps have already been taken to relieve the forest officials of this "encumbrance" and thus enable them to carry out their legitimate duties more satisfactorily. In connection with the working of the coupes, the question of so marking reserved trees that fraudulent substitution may be impossible, appears to be a difficult one to solve; "but, it is hoped that in this matter more careful checking of standards at the time of taking over coupes when the contractor's work is completed will produce better results."

Under the head of Buildings a total sum of Rs. 1,405 was expended. It appears that in Bombay all construction of, and repairs to, forest buildings are carried out by the agency of the Public Works Department. This method may work satisfactorily in many ways; but it seems a pity that small and petty repairs many of which do not amount to more than twelve rupees, as well as the construction of small quarters, should not be carried out by the agency of the Forest Department, whose officers, both at Cooper's Hill and at the Indian Forest School have received instruction in Forest Engineering. The Forest Department in the Bombay Presidency has many difficulties to contend with in attempting to introduce forest conservancy among a people who fail to understand its necessity. Moreover, frequent changes, frequent granting of concessions, and the want of a settled policy have done a great deal to aggravate matters. It is with satisfaction, therefore, that we note a degree of advancement towards a better state of affairs in the Northern Circle of the Presidency. Thus we read:—"No thefts of timber or destruction of forests upon a large scale have occurred, and the diaries and reports of Divisional Officers as a rule indicate that protection on the whole is fairly satisfactory."

But, on the other hand, it is a little difficult to reconcile these conclusions with the various details appearing in the body of the report. Apparently 1,855 forest offences were committed during the year, but only 702 were detected, and no less than 1,153 remained undetected, facts which would tend to show that petty timber stealing must be rife in the circle.

The cases prosecuted undoubtedly show a better result. There were 317 cases prosecuted, 256 convicted and 61 acquitted, the percentage of convictions obtained being thus 80·8. These results are satisfactory in more than one way, for they would tend to show that the magistracy are willing to convict in forest cases when evidence is forthcoming. No table is given to show in each case how far the punishment was made to fit the crime: but as far as fire cases are concerned the punishments would appear to have been adequate.

The bulk of the forest offences come under the head of injury to forest by fire and to unauthorized fellings or appropriation of wood. The total number of cases of grazing without permission, 213, are comparatively few in number; but these would appear to include a very large number of head of cattle. No less than 16,156 head of cattle were impounded during the year, and many of the cases relate to grazing within closed areas. That areas under natural regeneration, and especially the coupes lately coppiced require to be strictly closed to grazing, is an undoubted and irrefutable fact: but it is not certain that the closed areas of the northern circle are in all cases judiciously selected. It would be difficult to justify the closing of even selected areas to grazing in those reserves where *"the Department is powerless to prevent the destruction of the forests by dalkhi cultivation, which is carried on practically unchecked."*

In the Panch Mahals all the forests were closed to grazing between June 16th and August 15th, and nearly one-third of the cases of impounding took place during this interval. This period of 2 months' closure was apparently the result of a conference held by the Collector, the Assistant Collector and the Divisional Forest Officer, and it would be interesting to read a copy of the proceedings.

Fire-protection does not meet with any fair measure of success. The results of the year's endeavours are summed up as follows in the body of the report, *viz* :—"Forest fires have continued to baffle all efforts and it is only to be hoped that the disastrous returns of the year are due to the especially high winds" As a matter of fact 1,401 square miles were placed under special fire-protection, but only 1,278 were successfully protected, the proportion of failure to area attempted being thus 8·7. But these figures give an adequate conception of the damage which was apparently caused by fires. Thus we read that "the Dangs were, as usual, all burnt over" and, again, "in all Thana Divisions, in spite of special precautions

previously exploited coupes suffered badly from fires. In North Thana almost all are reported to have been burnt over ; in Central Thana more than one-sixth of the area, while in South Thana about one-ninth is given as the figure, but it is feared that this is too low an estimate." This is undoubtedly a matter which requires serious attention, for, as the Conservator states: " The danger of fires occurring in the exploited coupes is that the whole of the forest is thereby jeopardised, so that in spite of partial failure in preventing them no relaxation in the effort to combat the evil can be permitted, and it would seem good policy in future to concentrate the whole energy of the fire-protection staff on the preservation of these areas."

For reasons referred to above, it is especially gratifying to read of co-operation between the people, the Civil authorities, and the forest officials, particularly in connection with fire-protection. It is with pleasure, therefore, that we reproduce the following extract: " Assistance was freely given to the Forest Department by the Collector of the Panch Mahals, who evinced the greatest interest in all forest matters but more especially in those connected with fire-prevention. The Superintendent of Police constantly aided the Divisional Forest Officer by allowing the Police located near forest reserves to report outbreaks of fire, and to assist in the suppression of fire, both directly and by collecting villagers. The aid given by the Police in short, is worthy of special mention in this report. Lastly, and it is the most encouraging feature of the work, the village officers and villagers generally have shown willingness to assist in putting out forest fires, responding usually with alacrity at all times of the day or night to the calls of the fire-drums, or those of Forest or Police subordinates. The Divisional Forest Officer mentions that in 16 cases villagers extinguished fires of their own accord, without waiting to be summoned, showing clearly that ideas of fire-protection are gradually taking root in the minds of the Panch Mahals villagers."

Everywhere natural reproduction appears to have suffered severely from fire. Some interesting remarks are, however, made on the subject of the influence of the season of felling on the production of stool-shoots: " It has been observed that reproduction of teak from stool-shoots in the coupes depends greatly on the date of felling ; when delayed until after Christmas a good many stools fail to reproduce shoots, while those thrown up by others are weakly and few in number. It may be accepted as proved that, from the point of view of reproduction by coppice shoots that felling work should be undertaken as soon as possible after the cessation of the rains " It would be interesting to know how far these conclusions are being borne out by the valuable series of experiments, which are being carried out by Mr. Fernandez in Jabulpore.

Under artificial reproduction we read of broad-casting being done on a considerable scale in each division. We had imagined that

this system of sowing had long been abandoned as yielding results quite incommensurate even to the slight amount of labour involved. A certain number of seed beds in the Vegalpur nursery, Bulsar Range, were also opened out and relaid with a more or less impermeable stratum, some six inches below the surface, in order to check the downward growth of the tap-roots of teak seedlings and so obviate the necessity for cutting them when transplanting. The results will not, however, be known until the end of the rains of 1898.

Turning now to matters relating to the outturn of forest produce, we find that 247 coupes, with a total area of 14,768 acres, were exploited during the year, yielding a revenue of Rs 3,05,100 or Rs 20·6 per acre, as compared with Rs 28·5 per acre realized in 1896-97. This difference is attributed, and with every justification, to the dislocation of trade by the plague regulations. There appears, however, to have been a very large falling off in the yield of the coupes. The gross yield during the year under report is given as 1,610,772 cubic feet of timber, and 3,084,743 cubic feet of fuel, as compared with 2,757,876 and 8,771,765 cubic feet of timber and fuel, respectively, the gross yield for the previous year. This great difference must, however, be largely attributed to the fact that uniformity between the different divisions, as regards the classification of materials and the reducing factors for each class of materials was only obtained, for the first time, during the year under report.

The classes and co-efficients adopted in the Northern Circle may carefully be quoted here. They are as follows :—

A.—10 ft. long or under—"Kadis"

- a. Below 20 in. girth reckoned as 1 cubic foot.
- b. Between 20 in. and 30 in. girth reckoned as 3 cubic feet.
- c. Between 30 in. and 40 in. girth reckoned as 11 cubic feet.

C.—Logs over 40 in. in girth are actually measured and cubic contents calculated.

D.—Firewood is calculated at 17 solid cubic feet per cart-load.

The co-efficient for firewood appears to be very much higher than that adopted in other provinces. We note, however, that "further experiments are being undertaken to verify, or modify, as the case may be, the reducing factors, so that gradually something like real accuracy may be attained."

The net surplus for the year amounts to Rs. 2,63,556, in addition to which produce valued at Rs. 2,09,599, was given away in free grants and to right-holders.

Central Circle.—Special interest attaches to the perusal of the Central Circle Report for the year 1897-98 from the fact that at the

close of the year Mr. Shuttleworth, the Conservator, finally severed his connection with the department. Mr. Shuttleworth has been Conservator of Forests in Bombay for upwards of 30 years; and, to quote the report, "his long, loyal and devoted services are quite unique in the history of the Bombay Forest Department." Consequently his opinions on all forest matters pertaining to the Presidency, as far as these can be gathered from his comments on the workings of the year, must receive due weight and consideration.

The Conservator of Forests, Central Circle, at the close of the year held charge of a total forest area of 6,261 square miles and 567 acres; there having been a net decrease of 102 square miles, due to rectification of errors in the registers of the Western Division of the Khandesh District. It is anticipated, however, that the area managed by the Forest Department will very greatly diminish during the next few years, owing to the introduction of a very important change in the management of the forest areas of the Central Circle. Particulars regarding the alteration proposed are contained in Government Resolution, Revenue Department No. 1668, dated the 8th March 1898. Under these orders a very considerable portion of the reserved forests of the circle will be classed as "Pastures" and be removed from the control of the Forest Department and handed over to the charge of the Revenue Department.

It is difficult at this stage of the proceedings, and with the information now available, to arrive at any definite conclusions as regards the advisability, and the feasibility of carrying out these proposals. Everything must depend on the interpretation which is likely to be given to the orders contained in the Resolution above quoted. On the one hand, if it is merely proposed to excise small bare areas adjoining cultivations, with the object of allowing the villagers more breathing space, whilst merely slightly increasing the village waste area, no very great objection can be taken to the proposals, provided the conclusions now arrived at are taken as final; for nothing can be more detrimental to a settled forest policy than a continual encroachment on forest reserves. But on the other hand, we must view with great concern any attempt at a wholesale excision of forest areas for the purpose of forming fodder reserves under the management of the Revenue Department. Under such circumstances only two alternatives are possible. Either the fodder reserves will be managed with a view to their protection and preservation, if not amelioration, in which case the Forest Department is the one and proper agency to undertake their management, or, the "Pastures" will be handed over to the tender mercies of the villagers, when, to quote the report: "As pastures, the lands will, it goes without saying, under the unrestricted exercise of privileges of grazing and wood-cutting, &c., and in the absence of all protection, be speedily denuded of trees, and every vestige of

ligneous vegetation, so that for local supply cheap firewood will be unobtainable, and when the next famine comes round, the cattle of the south Tapti villages will find stones only upon the area, from whence they obtained life-sustaining supply of fodder during the recent famine."

The Commissioner of the Central Division appears to have realized the dangers of the situation, for he writes :—"As the pasture areas will practically become village waste, it is highly necessary for Collectors and their assistants to see that no lands which do not fulfil the conditions laid down by Government are withdrawn from forest conservancy." The conditions laid down by Government, however, appear to be quite inadequate, and apparently from a professional point of view, no safeguards of any nature have been introduced, since the final differentiation upon the broad lines given in the orders of Government remains practically with the Collector of the respective districts under the more recent orders." The valuation of forest areas is a matter which requires the special technical knowledge of a specially-trained officer, and a Collector can neither be expected to possess the necessary qualifications, nor to have the necessary time at his disposal. That our fears are not unfounded can be easily verified from the body of the report. One example will suffice. The Padampur forest reserve, covering a small area of 59 acres, was excised during the year, the Collector having reported that it would be no loss to the Forest Department as it only contains "a few *babul* trees round the edge and a sprinkling of *babul* bushes elsewhere." The Conservator, whilst approving of excision proposals on quite different grounds, very pertinently points out that this so-called valueless area had been divided into 6 compartments, 5 of which had been exploited, the average yield having been over 2,000 cubic feet of "timber" per coupe, giving an annual revenue of Rs. 1,000, besides an annual supply of valuable fodder grass, "which affords an object lesson of the very small importance attached to, and the low valuation given to "babul bushes" by the District Revenue Officer, who lacks, necessarily, the special professional knowledge of the Forest Officer as to the properties of the *babul* tree, which give to it the foremost place of the valuable trees of the Deccan plains in the agricultural and rural economy of the country." But no better test as to the dangers of the policy which is now being inaugurated in the Bombay Presidency can be applied than a reference to the nature of the work of disforestation which has been so far carried out. We cannot do better than quote from the report itself :—"In the *Khandesh District the Forest Settlement Officer*, three years ago, prepared lists of the reserved forest lands which he proposed to include in Pastures ; and these proposals have been approved and sanctioned by Government ; and according to them enormous areas will be removed from the charge of the Forest Department and

placed under the Revenue Department as Pastures; for example :—

(I) In the West Khandesh Division :—

(a) In the Dhulia Range, 66,579 acres of reserved forests are included in Pastures. All these lands are more or less wooded; taken all round they contain, practically, more than 20 trees to the acre, mostly young trees, which are coming on beautifully, since the areas have been under forest conservancy management. A forest block of 13,320 acres of fine *angan* forest, having a denser growth than 30 trees to the acre, and to which a working plan has been applied, under sanction of Government Resolution No. 9620, dated 20th December 1889, under which 2,00,000 cubic feet of *angan* firewood are being exploited annually from these forests for the firewood supply of the town of Dhulia, and its cotton steam factories, is included in the above. During the recent famine a very considerable number of local cattle were maintained in life and health in these forests, while at the same time enormous quantities of *angan* leaves were gathered and removed from the trees in the forests and taken all over the country to distant villages to stall-fed plough and other agricultural cattle which could not be driven to grazing areas, as they were required for work on the farms.

(b) In the Naudurbar Range the Pastures extend over 20,500 acres, of which a block of 8,000 acres contains an excellent growth of jungle-wood timber trees, with a very fair sprinkling of teak trees.

(c) In the Nizampur Range about 61,700 acres are classed as Pastures, of which a large part is now being worked methodically under a working plan for firewood for local supply, over 2,00,000 cubic feet of khair and other jungle-wood trees being the yield.

(II) In the East Khandesh Division, working plans have been applied to reserved forest areas, which have been placed into Pastures to the extent shown below :—

Range.	Number of forest block.	Total area.
Bhusawal	11	21,295
Bhadgaon	8	21,375
Edlabad	18	47,698
Esandol	6	18,167
Jamner	16	86,063
Pachora	5	15,384

All these reserved forests are covered with tree growth such as teak, jungle-wood, and babul. Here are timber, fuel and fodder ready to hand, mostly grown by the Forest Department since the great famine of 1876, and in several of the blocks compartments have become annual coupes during the past three or four years, from whence large quantities of small timber, firewood and fencing material have been made available to the people and local supply has been fed.

The Conservator has made a representation to the effect that these reserved forests have been erroneously classified as Pastures and that they ought, in the interests of the people and of forest conservancy, to be contained in Forest Proper, to which classification they rightfully belong by virtue of their timber contents, of the influence they exercise upon their surroundings, and their capabilities of service to satisfy existing demands on timber and other forest produce."

These results of the work accomplished up to date must speak for themselves : but a careful reconsideration of the whole question appears to be very urgently called for.

The grazing question may indeed call for some action, but a permanent solution of the difficulty can hardly be found in the total abandonment of all at the conservation and protection of the grazing areas. It would be interesting, for instance, to know whether it is necessary to absolutely close so large an area of the Government forests to grazing. The total area open to grazing is returned at 4,751 square miles, the area closed being 1,511 square miles, so that nearly one-third of the total area is closed to grazing. The greater number of working circles appear to be worked on a rotation of 40 years, so that it is a question whether more than one-eighth of the total area need be closed to grazing during any one year. As it is, during the year, 1,44,804 heads of cattle were found to be grazing without permits in closed areas ; and 73,496 in open areas : whilst 11,947 heads of cattle, covered by permits to graze in the open forests, were caught trespassing inside the closed areas. To prevent the trespassing of cattle inside closed areas, a very large expenditure, amounting to Rs. 18,239 was incurred on account of fencing. There are three methods for the management of grazing in forests, viz. :—(1) Free grazing ; (2) grazing on payment of fees ; (3) grazing by sale of the rights to do so. During the year 10,23,919 cattle of different kinds grazed in the forests, and of this number 3,84,950 enjoyed free grazing under free-grazing permits ; and besides a large number of cattle were permitted to graze as per special concession. As in the case of the other circles of the Bombay Presidency, forest offences appear to rise to very large proportions. Twelve thousand three hundred and forty-eight cases were discovered during the year, but in 2,221 the offenders were not traced. Moreover, it appears that 5,070 offenders were let off with a warning administered to

them, 1,898 cases were prosecuted in the law courts, the remainder being compounded under section 67 of the Indian Forest Act. In the Central Circle rewards are paid by Divisional Forest Officers to forest officials and others for detecting forest offences, a certain percentage of the compensation money taken from offenders being thus paid away. This procedure, and for very sound reasons, has not been received with favour when mooted in other provinces: but the Conservator, Central Circle, appears to be satisfied with the manner in which it has worked in his division. He writes :—" It works as it does in cases tried by Magistrates, not only towards improved efficiency in the protection of forests and in the detection of crime, but also tends to encourage the subordinates to be honest and to refrain from yielding to the temptation of entering into private composition with a detected offender."

Fire-protection appears to call for no special notice, except as regards its great cheapness. The results, however, were not very satisfactory, though we are not informed how far the coupes newly cut over were traversed by fire. The total area placed under special fire-protection was 40,14,243 acres, and 2,66,107 acres were burnt, or 6·6 per cent. of the total area. The expenditure incurred amounted to Rs. 1,552 only.

It is impossible to gather from the report what has actually been done during the year under the head of Working Plans. A Working Plans Officer, with a staff consisting of 5 Surveyors and 4 Muccadams were maintained during the year; but the whole of their time appears to have been taken up in demarcating and laying out the boundaries of compartments and coupes. Great activity was displayed in this connection: but whether to the best advantage seems a very moot question. The existing Working Plans are said by the Conservator to be merely "provisional"; and it would, therefore, be considered sufficient to lay out merely two years' coupes, when the staff might be more profitably engaged in preparing regular plans. As it is, 1,313 cairns and 3,025 walls or mounds were built, and 27,524 special stones were stuck up in the ground, and 2,515 short ditches were dug in defining the limits of compartments. It is to be hoped that these are more than the mere temporary limits of temporary workings. From para 17 of the report we gather that "3,853 square miles or 61·58 of the entire forest area has been put under *provisional* (?) Working Plans arrangements up to the close of the year, but only a few of the 40 exploitable compartments into which each forest block, contained within this total area, has been subdivided, have been defined by boundary works on the ground."

Under artificial reproduction, we read of a *new* method of raising teak, which was tried in the Haveli nursery with conspicuous success. The "*new*" method consists in sowing the seed plentifully in a seed-bed about the month of February,

covering the bed with straw and watering daily. The seedlings appeared in May, or after the seeds had remained above three months in the soil, instead of eighteen months, as is ordinarily the case, when sprouting is not stimulated.

The babul, *Acacia arabica*, forests of the Central Circle are worked on a system of clear fellings, the coupes thus exploited being subsequently ploughed up and sown with seed. We should be glad to receive some information as to the results of this system of working, the report giving no clue on the subject.

Two matters relating to the exercise of rights and privileges inside the Government forests call for special notice. The first relates to the mountainous portions of the Poona district:—

“In the Poona Division the cutting of bushes, young trees and brush-wood for rāb by privilege-holders went on as heretofore over 12,576 acres of old *garrair* land in the Maval Range. A recommendation made by the Forest and Revenue Officers, both District and Controlling, to stop the exercise of this pernicious privilege which is denuding the hill sides on cross ranges of hills abutting from the eastern crest of the Western Ghat or Syhadri mountains and can only result in the promotion of floods and the erosion of soil from the high levels with its deposit in the low-lying fields and in river-beds in diminishing the natural storage of water and creating other detrimental effects, was urged, but Government directed in June 1898 that the cutting should not be stopped.”

As regards the second matter we cannot do better than quote from a report of the Commissioner, Central Division. He writes:—“The Khandesh forests have always been a very valuable property. On the completion of the Tapti Valley Railway they may be expected to yield a much larger revenue than in the past, but there will also then be greater inducements in the stimulus which the railway will afford to the timber trade for the exercise of the wasteful privileges conceded to the Bhils under the North Tapti Forest Code. There were doubtless good reasons for special treatment of the Bhils when the privileges were granted, but the railway will open to them, directly and indirectly, fresh sources of employment, and a modification of the rules such as may prevent the rapid destruction of valuable forests can probably now be carried out without entailing any real hardship on the population.”

The financial results of the year were disappointing if not altogether unexpected, and for the first time in the decade a deficit of over one lakh of rupees has to be recorded. The report explains this as follows:—“The results of the Forest year 1896-97 were largely influenced by famine. In the year under review famine conditions were nowhere severe. Nevertheless, the effects of two bad seasons in succession manifested themselves in most districts of the Circle and were aggravated by the depression in trade ensuing on plague and plague operations.

The commercial transactions of the department were consequently very unprofitable. The prices realized were poor, and large stocks remained unsold. The privileges of free grazing, originally granted on account of the famine and partially continued during the year, also contributed to the reduction of revenue. The net result at the close of the year was a deficit of Rs. 1,11,521. The receipts were the lowest realized in any of the past ten years. A comparison with the revenue collected in 1896-97 points to a decrease of Rs. 2,05,748. All the districts of the Circle, except Khandesh, contributed to the deficit. Between the two forest divisions of Khandesh there was an excess of receipts over expenditure to the extent of Rs. 1,27,687."

V.-SHIKAR, TRAVEL, &C.

A sixty mile walk.

In the "Indian Forester" for June, "A. C." alludes to a walk I once did in the Chanda District, and it has struck me that it might not be uninteresting to give an account of the circumstances under which it was undertaken.

I had joined the Department some 15 months previously and was then in charge of that part of the Chanda Division known as the Pranhita—Godavary Sub-division which comprised some 1,640 square miles of Government Forest, including the well known valuable Allapilli teak forest. This latter forest had then been successfully protected from fire for some 18 years; so I was doubly anxious lest any fire should take place while it was in my charge.

In the middle of March 1891 I had reports that a large man-eating tiger had taken up his residence in the Mirkullu block of the Allapilli forest, and on the 24th of that month I heard that during the last few days one of my fire-guards had been taken off and eaten and also that two other persons had been killed near the fire-line. The Ranger added that all the fire-guards refused to work and that he could not be responsible if a fire occurred. These were the circumstances that decided that I must at all cost reach the spot as soon as possible. An officer M.—, a year junior to me happened to be with me in camp at Sironcha at the time, and it was perhaps partly due to his maintaining it was impossible, that I decided to walk to Allapilli the next day, my pony being laid up with a cracked hoof. I had one piece of work to do before I left the Sironcha forests

and that was to inspect a short length of disputed boundary between Government Forest and Ahiri zemindari. To go *vid* this place made the distance exactly 62 miles.

M—saw me off at 1:30 a. m. on the 25th. I decided to start early so as to get the benefit of the cool air, and as there was a bright moon it made the going at the start very pleasant. A *Gond* named Pinta who was with me in camp volunteered to walk with me, and we arranged to carry the rifle in turns. We took another coolie with us to carry food and water but he had to be changed every 10 miles or so, as it was difficult to get men to go further than from one village to another. The day, 25th March 1891, was the "*holi*" festival and rendered it more difficult to induce coolies to come with us. Short halts were thus enforced on us wherever we had to change coolies and it may have been due in a great measure to these compulsory halts that I got through the walk all right as they prevented my overdoing it in the first part of the walk as I should have done very likely otherwise. I cannot now find details of the intermediate times but I reached Allapilli at 9 p. m. that evening, very fairly tired of course, but nothing compared to poor Pinta, who having bare feet, had knocked them terribly on the rocks when he got tired. The whole road is only a cart track and over a rocky soil for a good part of the way. I had no dinner awaiting me but the Forest Ranger, who was a Mahomedan, had an excellent meal cooked for me and it was not long before I was asleep. The next day I reassured all the fire-guards and gave them buffalo calves to tie out in all the likely places. On the 30th, at about 12 o'clock I received *khhabbar* that the tiger had killed about 10 miles off near Mirkullu. By the time I made my arrangements and walked over there, it was getting late.

The buffalo which had been taken had been tied out on the fire-line some miles north of the place where the fire-guard had been killed. On the reserve side there was dense grass, 4 to 5 feet high, with scattered trees 30 or 40 feet high. Into this grass the *gara* had been taken. We followed it for over a quarter of a mile and then found that only the head and a small piece of the neck remained.

I had not much experience of tigers then, having only killed one before that, and in my ignorance I thought the tiger, especially as it was the very man-eater, would never return to such a poor meal. However, I decided I would sit up till dark and then tie up another buffalo. Thinking thus, I gaily mounted my *machan*, clad in thin *khaki*, with no food or water. Up to dusk I saw or heard nothing. About half an hour after dusk I heard a heavy animal stamping through the grass. I thought it must be a bison or buffalo, both of which are found there, but as it came nearer I could see nothing. Then all of a sudden I saw a huge tiger standing over the remains of the kill. He was standing half right with regard to me, that is, facing my left, about 25 yards off.

I immediately blazed a snap shot at him, as I could not see my sights. He rolled over into the grass, roared and pawed the ground but he had got behind some shrubs and grass and I could not see him. I fired a second shot where I thought he was and then he slowly dragged himself off into the ocean of grass, grunting terribly as he went.

Now I was in a fix, as I did not think it good enough to get down into that grass and walk a full quarter of a mile to the fire-line in the dark, as I was sure the tiger was badly wounded near by, so I decided to make a night of it. My men came a little way from the fire-line but I yelled to them to return, and there was I in a thin *khaki* suit on a *machan* some 2 by 3 feet, with nothing to eat and drink. Had I had any hope that the tiger would come I should have had a *charpoy* tied up and taken some bedding, food and water. As it was, a cold wind sprang up, and by midnight I had high fever.

Next morning I felt very bad but I was so certain the beast was dead I followed up the track, posting men in trees to keep a lookout ahead. At first the track was very plain. We found three places where he had lain down and left great quantities of blood. Then we found a place where he had apparently dragged himself along with his forefeet, all ten nail-marks being repeatedly found on the ground. However, the blood got less and less and eventually we lost the track and as the sun got hotter I felt worse, and at last gave it up. However, as after that we heard no more of the man-eater I was firmly convinced that he had crawled off to die. I had had then no experience of how well wild animals can recover from almost mortal wounds.

The next year, 1892, I happened to get re-posted to the same subdivision and heard that a tiger had taken to killing men during the past few months, but his sphere of action seemed to be some 20 miles or so south-east of Allapilli. On 24th February on returning to Allapilli from tour, two fire-guards at a *naka* a mile east of Allapilli came and told me a huge tiger had been hanging about their *naka* for two or three days. At night they slept in a high *machan* and they declared he kept wandering beneath. I gave them a buffalo to tie up at the *naka* and on the 25th morning they brought news that it had been killed. The tiger had dragged it into a thick undergrowth to the north of the *naka*, and should he remain there as I thought he would, since he was so daring, the beat would indeed be a simple one. To the south lay a cart-road, to the east a broad fire-line and to the west a broad sandy *nala*, these two latter converging a few hundred yards to the north so that the distance between them could be easily covered by one gun. By quietly placing stops on the outer edges of the fire-line and *nala* and putting the beaters on the cart-road, I had all in readiness.

I carefully stole up the fire-line and as I was afraid of making a noise by tying up a *machan*, I put on my climbing irons (which by the way I always have with me in a big forest) and climbed up a thick tree (a species of *Acacia* if I remember rightly) and sat on the lowest branch, a horizontal one, some 20 feet from the ground. The beat commenced and in a short while a huge tiger appeared leisurely walking a few steps, then stopping to look round.

I got a beautiful shot at his chest, as he topped a mound, and he rolled over ; while the recoil nearly sent me backwards over the branch, a horizontal one being most awkward to shoot off. However, I recovered my balance and the tiger his, as he took four more bullets to kill him.

I was delighted, of course, and more especially as I found he measured 10 ft. $\frac{1}{4}$ in. between pegs at his nose and tail (body 6 ft. $7\frac{1}{4}$ in. tail 3 ft. 5 in.). On skinning him we found one of my solid .500 Express bullets under the skin on his right hind-quarters and a scar behind his left shoulder. This then was the same man-eater I had fired at on the 30th March 1891. There was no doubt about it, as the direction of the bullet corresponded exactly, and no one else had been shooting with like bullets in that part. I had by mistake put in a cartridge with a *solid hardened* bullet instead of an *Express* one ; and had I placed an Express bullet in that position I should have bagged him at our first meeting, since the solid bullet must have passed within an inch or two of his heart, while an Express bullet would have broken up, and certainly have damaged the heart.

F. Z. S.

An out-caste Elephant.

The following is an account of the way a young elephant lost caste with its people, and was rejected by the jungle-folk, as witnessed by me, a Forest Officer, on tour.

It happened in this way—some nine years ago I was in charge of the Ganges Division, and after spending a few days at Ohila, a bungalow on the left bank of the Ganges, and nearly opposite Hardwar, I moved my camp northwards to the Kanaun bungalow, which, unlike Ohila, is built on the top of a highish cliff immediately overlooking the Ganges. In the rains, no doubt, the cliff is river-washed but at the time of which I write, there was a narrow strip of beach between the foot of the cliff and the water, and a zigzagged path led down to it from the plateau on which the bungalow was situated. On arriving in camp, as is my usual custom, I took a stroll round the '*parao*'

and it was naturally not many minutes before I found myself on the extreme edge of the cliff, from whence I knew that a magnificent view up the river could be obtained. On reaching this point of vantage my attention was almost instantly attracted to a black object in the water some way further up stream, which now and again appeared only to completely disappear again and again, but which was rapidly approaching the spot opposite to where I stood. It was not many seconds before I recognized that the strange-looking black object, was nothing more or less than the head and trunk of a young elephant, and if I could have doubted the evidence of my eyes, my ears would have told me the same thing, as every time the little beast got its head above water it gave vent to a curious scream, which was only attributable to a frightened young elephant. Calling to my orderly to follow, I ran down to the river and waded out about 30 ft. into the water by which time the water was well above my waist and it was becoming a matter of great difficulty to stand against the current, and waited for the elephant to be washed down to the same spot. By this time my orderly was also in the water and shortly afterwards the baby elephant was carried down upon us, and between us we were not very long in capturing and bringing him ashore in a half-drowned condition. He was quite a little fellow, standing about 3 ft. at the shoulder and was not probably more than a few weeks old. After landing he stood still for some minutes to recover himself and to empty himself of the water, of which he had evidently freely partaken, and which now poured from his trunk, then suddenly resenting the curiosity I evinced in his welfare, he unexpectedly charged me and,—what might be expected, was my undignified fate.

I then, with the help of the orderly and others, tried to persuade the little elephant to go to the top of the cliff, but nothing would induce him to budge a step, and the more we pushed and pulled, the more obstinately immovable he became, so I called in other help in the shape of two female Government elephants and a rope—the latter tied round the baby elephant and attached to the former was most successful and though at first the captive was only moved by brute force, he very soon trotted along of his own free will by the side of his relatives. Once at the camp he seemed very subdued; in fact it was some hours before he got over his experiences of a ducking in the river. I gave him some milk by pouring it down his throat out of a wine bottle and got him all kinds of dainties in the way of green stuff, but of the latter he would have none.

The same day, late in the afternoon, I heard far away in the distance, the frequent roaring of an elephant and I judged that there was one search party. and that the mother, out in quest of the little elephant, now comfortably installed in my camp. Thinking that perhaps I might have difficulty in rearing so young an

animal, I decided to return him to, as I supposed, his sorrowing parent. Accordingly with this intention I again fastened him with a rope to one of the Government elephants and led him forth into the jungle—time about 6 o'clock—and went in the direction of the still bellowing mother. When I thought we were within a quarter of a mile or so of her, I tied the youngster to a tree, sent my elephant some distance off, and climbed into the tree myself to watch the *tamasha*. Very soon the elephant began to answer the mother's calls and I hadn't long to wait, before she, accompanied by a big tusker, made her appearance. The little elephant in his excitement, at once forgot he was bound and charged forward, but with sufficient force to break the rope, and the next moment I saw that he was free and hurrying towards the big couple, who immediately turned round on their own footsteps and followed by the *bacha*, were quickly lost to sight in the thick jungle. This was the last I expected to see of my little elephant and after having given the reunited trio time to get away, I descended from my look-out and went back to camp. I thought no more of the elephants, till to my very great surprise, about 10 o'clock that same evening, I was informed by one of my servants that the little elephant had returned. Disbelieving the man's very improbable statement, I went out to see for myself and sure enough I found it to be a fact, and a fact which I could only account for, by supposing that the wild elephants would have nothing to do with their young one after its having been handled by man, but even if my supposition is correct, and the parents did cast him off, it is curious, that he should have thought of returning to his human friends, and in a less degree, than that he should have found his way back to my camp. Having elected me as his proper guardian, I could do nothing but keep the *bacha* and very soon he became a very affectionate pet and would follow me about and greet me by twining his trunk round my neck. For other human beings he did not manifest the same fondness and the unwary stranger usually took the same humble position as I myself had been forced to take on my first introduction, but then, his charge was irresistible. One of my Government elephants soon became very fond of the baby and I believe after a bit fully looked upon him as her own young one, and the feeling of affection being reciprocated by the youngster, the two were soon practically inseparable.

Shortly afterwards I had to make some long marches and thinking it best to have the little elephant in one place, I left him at Kanaun along with his foster-mother. To let him out of my sight was a great mistake, as I discovered ten days later, when I got a report from the *mahaut* in whose charge I had left the elephant, to say that the *bacha* was dead. The *mahaut* attributed its death to an unpropitious fate. *Kismet* has to answer for many things, and among other thing the sore back of a certain *mahaut*.

VI. EXTRACTS, NOTES AND QUERIES.

The Courtship of White Ants.

I was recently a witness of a scene in the domestic economy of white ants, which, if it has not been previously recorded, may prove of interest.

I was out for an evening stroll in April, after a smart shower of rain, when I noticed the air to be fairly thick with the winged sexual form of the common white ant (*Termes taprobanes*) which were pouring out of several holes in the ground.

They flew about at first in an aimless way affording an evening meal to a number of birds, among which several kestrels were conspicuous.

After a time certain individuals (females) settled on the ground or on rocks, in conspicuous places, and began to vibrate their wings rapidly. This was obviously to attract the attention of the other sex, for in a short time in each case, another ant, this time a male, settled close to the first and ran up to her.

Upon the arrival of the sterner sex, the lady-ant ceased fanning and began to run away, being followed closely by the former.

The chase usually lasted some time, the coy female being apparently unwilling to be won too easily, or possibly wishing to test the perseverance of her admirer. After a time, however, she allowed herself to be caught, and then the strangest thing of all happened. The male deliberately bit off the wings of his mate, one by one, and having done so he threw off his own, by a curious jerky movement which was difficult to follow. I would not be certain that his legs were not partly used in divesting himself of his wings, but although I watched the proceeding carefully in several cases, I could not be certain how it was effected. The wingless insects then walked off, the female still leading, and entered the first convenient hole in the ground they came across, where I presume they started a fresh colony.

B. B. OSMASTON.

White Ants and living Bamboos.

It is generally supposed that white ants eat only dead things, but recently a case of their attacking young mango trees has been brought forward, the plants being attacked, if I

remember rightly, very soon after being put out. There is reason to believe that the planter was also put out as soon as ever he discovered it.

Recently, there were a lot of 2 to 3 year old plants in baskets put out in my garden. *viz.*, 20 camphor and 70 bamboos of various species. The day after planting, or may be two or three days after (for the work lasted 3 days) all the plants looked flourishing except that the leaves on a few shoots had rolled up as though scorched by the sun. Now, there had been no sun. A slight pull revealed the fact that the shoots had but half an inch of stalk in the ground and appeared to have been eaten off. Further search brought out some white ants, still clinging to the eaten ends, so there could be no further doubt as to the culprit. Up to the date of my departure only about half-a-dozen plants had suffered, but this I put down to my having at once manured the white ants with a dilute solution of phenyle. They may perhaps return as soon as the effect of the dose has passed off. On the other hand they may only attack plants that are actually in difficulty, and the roots may have established good connection with the soil before they return.

This touches the question whether, in basket-planting, the basket need be removed. The general practice is to slit the basket before putting into the pit so that it can be pulled out when the young plant is seated. But baskets are often so rotten that the greater part of the basket remains buried. Is any harm done? Some say the bits will attract white ants. Others say they make no difference. There can be no doubt that they will attract any white ants that find them. But that need not necessarily make any difference to the plant. Possibly the debris may lead the white ants to attack the plant, but it can, I think, not be laid down as a rule that they will do so. On the other hand it is possible that the remains of the baskets may be of use in keeping the white ants employed till the young plants need no longer fear attack. The question is a difficult one to work out experimentally, so much depending on the numbers (and perhaps species) of the termites and on the available quantity of other food.

F. GLEADOW,

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

July 4th, 1899.

EAST INDIAN TEAK.—The deliveries for the first six months of this year amount to 10,414 loads, as against 10,767 loads in

the same months of 1898, and in June this year to 1,911 loads against 1,667 loads for June 1898. A good retail demand has been apparent during the month at satisfactory prices. There are no forward transactions for floating cargoes to report, but quotations are still firmly maintained, and supplies are small.

ROSEWOOD.—EAST INDIA.—As imports continue light and the demand good, prices are firm and stocks are not accumulating.

SATINWOOD.—EAST INDIA.—Stocks are sufficient for current demand, which is rather dull.

EBONY.—EAST INDIA.—Is often asked for.

PRICE CURRENT.

Indian Teak, per load	...	£11 5s.	to £16 5s.
Rosewood, „ ton	...	9£	to £11
Satinwood „ foot(superficial)	5d.		to 12d.
Ebony „ ton	...	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST JULY, 1899.

TEAK.—536 loads of logs and planks were landed in the London Docks during last month, as against 1,210 loads for the corresponding month of last year. The deliveries from the Docks into consumption were 1,884 loads, as against 1,575, loads in June 1898. The Dock Stocks at date analyse as follows:—

6,048 loads of logs, as against 10,276 loads at the same date last year.

2,886 „ planks „ 3,226 „ „ „ „

24 „ blocks „ 20 „ „ „ „

8,958 loads „ 13,522 loads.

The above figures are very striking in respect to the stock of logs, which shows a decrease of 4,228 loads, or 41 per cent. as compared with the stock on the 30th June last year, whilst the stock of logs, planks and scantling combined—8,958 loads—is the smallest quantity of teak on hand during the last two years.

The following are the comparisons between the past half-year and the corresponding one in 1898:—

Landings in Docks from 6,213 Lds. in 1899 as against 10,547 1st January to 30th June Lds. in 1898.

Deliveries „ „ 10,298 „ „ „ 10,502 „ „

The delivery into consumption of 10,298 loads from the London Stocks has been a very good one for London, seeing

that no portion of the supplies to H. M. Admiralty has come via this port. There has also been a well sustained demand upon the stocks in the ship-building rivers, and the Continental demand has been good, so that, altogether, the rate of consumption for the first six months of the year points to the probability of even last year's record consumption of some 82,000 loads being reached, if not exceeded, this year. Prices have naturally continued to harden, in face of so good a demand, and of the steadily increasing cost of the moderate supplies at the shipping ports.

There is a growing tendency to buy from landed stocks, or in moderate-sized parcels shipped by steamer, rather than to purchase large sailer cargoes afloat. The present level of price is perhaps too high to induce consumers to stock such cargoes of 1,000 loads or more, but it is not to be doubted that those who have had the courage to buy floating cargoes now hold better and cheaper stocks than the ordinary run of steamer parcels, and there seems little doubt that, for the present, wholesale buyers will do well to keep themselves covered for their likely requirements for the rest of the year, as the cost of shipment cannot, in face of the limited stocks at the shipping ports, decrease for a long time to come, and the buyer of floating cargoes effects a large saving in landing and rent charges, which necessarily have to be added to the sale price of landed stocks.

MARKET RATES OF PRODUCE.

Tropical Agriculturist.

July 1st, 1899.

Cardamoms	per lb.	2s. 9d.	to	3s.
Croton seeds	„ cwt.	40s.	to	55s.
Cutch	„ „	28s.	to	35s.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	65s.	to	75s.
India rubber, Assam	„ lb.	2s. 10½d.	to	3s. 3½d.
„ Burma	„ „	2s. 9d.	to	3s. 2d.
Myrabolams, Madras	„ cwt.	6s.	to	6s. 6d.
„ Bombay	„ „	4s. 9d.	to	10s.
„ Jubbulpur	„ „	4s. 3d.	to	6s.
„ Bengal	„ „	4s. 6d.	to	7s.
Nux Vomica	„ „	8s.	to	10s.
Oil, Lemongrass	„ lb.	2½d.	to	2½d.
Sandalwood, Logs	„ ton	£20	to	£50.
„ Chips	„ „	£4	to	£8.
Sapanwood	„ „	£4	to	£5.
Seedlac	„ cwt.	55s.	to	66s.
Tamarinds	„ „	10s.		

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

6th July, 1899.—No. 608-*F.*—On return from the privilege leave granted him in the Notification of this Department, No. 878-*F.*, dated the 20th April last, Mr. A. F. Gradon resumed charge of the appointment of Instructor at the Imperial Forest School, Dehra Dun, in the forenoon of the 22nd June 1899.

From the same date the services of Mr. S. Carr, officiating Instructor, were replaced at the disposal of the Government of Burma.

14th July, 1899.—No. 635 *F.*—Mr. C. G. Rogers, Deputy Conservator of Forests, 4th (officiating 3rd) grade, Bengal, is placed on special duty under the Inspector-General of Forests, with effect from the 6th July 1899.

14th July, 1899.—No.—640-*F.*—With reference to the Notification of this Department, No. 576-*F.*, dated the 23rd ultimo, Mr. J. W. Oliver, Conservator, 2nd grade, assumed charge from Mr. H. C. Hill, Conservator, 1st grade, of the School Forest Circle and the Imperial Forest School, in the forenoon of the 6th July 1899, from which date he will officiate in the 1st grade of Conservators, until further orders.

Mr. Hill received charge of the office of Inspector-General of Forests from Mr. B. Ribbentrop in the afternoon of the 8th July 1899.

20th July, 1899.—No. 645-*F.*—Mr. Gleadow, Deputy Director of the Imperial Forest School, Dehra Dun, is granted privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations, with effect from the forenoon of the 12th July 1899.

From the same date and until further orders :—

(i) Mr. A. F. Gradon, Instructor, is appointed to officiate as Deputy Director of the Forest School, *vice* Mr. Gleadow.

(ii) Mr. R. McIntosh, Deputy Conservator, 4th (officiating 3rd) grade, Madras Presidency, is appointed to officiate as Instructor at the Forest School, *vice* Mr. Gradon.

2.—MADRAS GAZETTE.

29th June, 1899.—No.—308.—Appointments.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion	Remarks showing cause of vacancy, &c.
1	Mr. H. J. A. Porter.	Dy. Cons. of Forests, 3rd Grade, and acting in the 2nd Grade.	Dy. Cons. of Forests, 2nd Grade.	Permanent	<i>Vice</i> Mr. W. C. Hayne retired.
2	„ C. D. Mc Arthy.	Dy Cons. of Forests, 4th Grade and acting in the 3rd Grade.	Dy. Cons. of Forests, 3rd Grade.	Do.	<i>Vice</i> No. 1.



THE INDIAN FORESTER.

Vol XXV.]

September, 1899.

[No. 9.

Our Illustration.

The photograph we reproduce with this issue represents the Rhinoceros described by F. Z. S. on pages 265-8 of the June number of the *Indian Forester*.

Concessions.

All those who appreciate the general subject of the economic welfare of India, and are alive to the very real place the 'Forest' plays in that economy, will have read with interest the able and temperate paper in the April number, on the effect of 'Concessions' of (free, or partly free) grazing, timber, &c., in the Oudh forests—'concessions' being made in cases where, it is admitted, no kind of *right of user* exists. It is rather late perhaps, to pursue the subject, but it takes time for papers to reach England and be answered; and as a matter of fact, the question, in this instance, does not depend for its importance on the precise moment. Such cases constitute an abiding difficulty in Forest management; and if the natural tendency of Forest Officers is to turn away from such—to them hopeless—difficulties, and rather devote their attention to interesting questions of silviculture, it is not the less necessary, from time to time, to take out into the light, the very serious menace to the economic welfare of the agricultural population which such cases indicate. Forest Officers are ready to exclaim. 'What can we do?'; and naturally so: but that makes it all the more important to undertake the unpleasant rôle of a 'prophet of ill,' and by seriously calling attention to dangers ahead, to exculpate ourselves from any future charge of indifference, or of complicity in the matter. If the responsible authorities refuse to take warning, upon them must rest the responsibility for the consequences.

The whole circumstances of the *right to land*—whether waste or cultivated—in British India are extremely peculiar. When the British Government obtained (by grant, cession, or conquest)

the administration of the provinces, it succeeded on well known principles of law, to all the *de facto*, long-settled claims and rights of the preceding Government. And as regards the ownership of land, it is no doubt obtained on almost absolute right; but the right was such that it could not be exercised, by a civilized Government, without large modifications.

We may put aside here the question of the general State right as regards cultivated land, because that was definitely met and disposed of sometimes by means of 'landlord' arrangements, as in Bengal, Oudh and other places; sometimes by the recognition of the right of village communities, which were given the proprietorship of defined areas, both waste and cultivated, within the village boundary land down by survey; sometimes on the *raiyatwari* principle, as in the large provinces of Madras, Bombay, Assam or Burma.

But the right of the State to dispose of or retain for public use, the waste and forest area, is among the most ancient and undisputed features in oriental sovereignty. It is probably as old as the Hindu monarchy itself. No sovereign ever felt any doubt about his right to retain large areas as hunting grounds, or to punish with ruthless severity, any injury to woods or to wild animals—even when the latter were committing depredations on the crops or were actually dangerous to life in the adjacent villages. When such a reservation was not contemplated, the right to issue unfettered grants to cultivate and 'reclaim' the waste was a matter of daily custom and exercise. And there were often Feudal Chiefs and subordinate magnates who had a virtually similar right in their domains. And when these afterwards (as often happened) became 'landlords' under British rule, it was a question how far large areas of waste and forest—entirely unoccupied and not 'possessed' in any tangible form by them—could be held to form part of the 'estate' recognized as their property. Very often the matter was left undefined, at the outset; the estate was neither demarcated or surveyed, and thus there was no equitable decision as to what lands were, and what were not, included. After some years, it was found impossible to do anything and so large areas were practically lost to the Government and to public use.

But, apart from the State right to forest and waste as a general and unquestionable fact, the *practice* of all times introduced limits. The right was only exercised in such a way as not to interfere with grazing grounds close to villages, or to prevent the acquisition of the necessary fuel and wood. When the British settlements were put in operation, it was often possible to provide for the customary and indefinite user, either by assigning a tract of 'waste' to the village as its joint-property, or by leasing certain lands set apart for grazing, &c., which were never included either as State Forest ('reserved'), or as that vague kind of thing called 'district forest' or by some equivalent name.

But, after all such arrangements were made, there were still cases in which the tracts of woodland, fairly, and on general grounds, claimed as State or public forests, were resorted to by adjacent villagers or by nomad tribes; and the Government had for many years taken not the least notice of such customary user, any more than it had of the forest itself. It is true that here and there, exceptionally valuable forests of teak, sāl or sandalwood received some kind of attention. Of late years it has been the fashion to magnify these spasmodic acts into important efforts at conservation; but at best they were made in total ignorance of the most elementary considerations of forest knowledge; they were mere efforts to defeat rascally contractors and get a cheaper and easier supply of timber for public works, and usually ended in the local extermination of the valuable species. Occasionally, too, an enterprising officer would start a plantation, of which Nilambur is a noteworthy instance; but such attempts, however praiseworthy, have no real effect on the general economic condition, from a forest point of view. All the early action taken regarding the southern forests, was taken without the least conception of the all-important question of the "possible yield" or of the replacement of the extracted stock.

But this is a digression:—the real fact is that forest questions received no general attention for nearly a century after British rule began. It was not till 1828 that the Bengal law formally declared the ancient rule, that waste and unoccupied land belonged to the State. And in 1860, when Lord Canning wrote his celebrated minute urging the utilization and disposal of waste lands in general, not a word was said about reserving tracts of wooded or grass lands for public forest purposes.

When at last the Forest question was really taken up with practical knowledge and ability in Burma, under Lord Dalhousie, and some years later reached the Indian continent, the invasion of forest tracts in many parts by the host of right-holders(*usagers*) had so long been permitted and grown customary—with the increase of population and the multiplication of cattle which resulted from the *pax Britannica*,—that it was impossible to suggest any harsh or summary dealing with the case.

The strict legal position of such users of the forest, or its products, it was equally impossible to define. Legal arguments might show that the exercise was not 'prescriptive,' the conditions of a legal prescription were wanting; and so forth. But all such technicalities were necessarily and properly brushed aside; it was decided to deal with "forest-rights" as if they were 'rights' in a European forest country. They were not only recognized in principle as such; but far more liberally dealt with than in France and Germany; that is to say, the rights were allowed, and the conditions of proof, the restrictions and limits and other counter claims, were not prescribed. The time was not ripe for legal niceties, and the Forest Act did the best it could (under

the circumstances of much ignorance and opposition). There has, therefore, always been a considerable laxity in the terms—and still more in the application—of such rules as exist. 'Rights' have been allowed, in cases where there was no title or no ground for them; the 'definition' such as the law requires, was not carried out; and so forth. But still something was done; and it was useful as far as it went: when once the essential points of a tolerably definite local claim, and a record of some kind are attained, it is always possible to effect improvements afterwards.

These considerations of the freedom, and even laxity, with which 'rights' were allowed, are not irrelevant; for when such provision was already made, it follows that the grant of 'concessions,' though obviously within the power of the Government, ought to have been very sparingly made; and only in cases of real and proved hardship. The case in Oudh seems to have been one quite outside this exception. Why should the mere accident of being within an (arbitrary) three-mile limit give a claim to consideration? Other villages, further off, would be just as much in need of the help. It amounts to this; that certain holdings are favored by a pecuniary advantage over others, in paying their rent, that is what it comes to. And as regards cattle-owning tribes not belonging to the locality, nothing can be said in their favor. It seems as if the power of 'concessions' was to prove an easy means of avoiding the Forest law, already wide enough in its terms.

But it will be said; it is no use raising such questions; the authorities *will* have it so. The real truth is, that they do not appreciate any question of forest economy; and their firm, if unconfessed belief, is that forest conservancy is more or less of a fad, or at least only applicable to limited tracts of undeniably valuable timber-growth. It is a fixed opinion that if the common woodlands of the country are let alone, without any treatment except the prevention of gross abuses (of which burning the forest is not one!) the forest will go on supplying grazing, grass and ordinary wood to any extent whatever; and it is mere folly to prevent the people from doing whatever they please—short of breaking up the soil for cultivation.

The only thing that can be done is to give a serious warning, from time to time, that such notions are absolutely fallacious. But something can be done to check the evil.

In the first place, if 'concessions' are given, it should surely be *only* to residents, not to outsiders; it should be solely for personal use and not for sale: the only exception being where the petty sale of bundles of grass, gathered leaves and bamboos is the privilege directly contemplated.

In the next place, the *financial* aspect of forest conservancy is surely one that will, at any rate, be intelligible to the authorities of all grades. Now, in the case of rights, the value of the produce

taken is of no account, because, *ex hypothesi*, it does not belong to the State : what the public has to consider is the residue which belongs to it after such deductions are made. If I have an estate of £300 nominal, but subject to a permanent jointure of £100, I can only consider £200 as the effective property which I have to deal with—as far as value is concerned. But with ‘concessions’ it is quite otherwise. Here the State is giving away, voluntarily, what it might otherwise apply to the reduction of taxation, and the public should know, approximately, what is thus being taken from the public purse. This would be only one point : but it is something.

Then, there is a consideration, which is perhaps the most important of all. What will become of these people you are favoring when the forest, worn out with the excessive grazing, burning and unreplaced cutting, becomes a barren waste ? People *must* be made to face this, for at present their only answer is a vague belief in the practical inexhaustibility of ordinary woodlands. They cannot realize that in every class of forest it is our imperative duty to take the annual increment, not the capital ; and that there is a limit to the annual increment, much narrower, than is supposed. The worst feature of ‘concessions’ is that they are almost invariably made without giving any plan of allowing the different parts of the forest any rest or recovery ; and they are made without the least thought or calculation whether the forest can properly yield this amount of material or grazing or not.

Efforts should be persistently directed to establishing an approximate estimate of amount of wood that can be taken in those concession areas, even if it is more generally and widely stated, than is the case in regular forests. And it should be resolved to consider the ‘possibility’ of grazing and find some rough and ready rule for fixing numbers. People can then be told ; this is the total amount of wood of kind (*a*, *b* and *c*) you can have ; arrange among yourselves how it is to be divided : this is the area of grazing that is open ; and this is the number of cows, buffaloes, sheep, &c., it will support : determine among yourselves how many cattle each person is to graze accordingly.

B. H. BADEN-POWELL,

Oxford, August 1899.

The Regulation of Pasturage.

The *Revue des Eaux et Forêts* for the 1st May last, contains a long article on the Regulation of grazing by M. M. Broillard and Cardot, which seems worthy of reproduction at some length in the

Forester, as many of the difficulties described are equally to be met with on the hill regions of India. In the same Review for the 1st April, there was an account of the work of the Agricultural and Sylvicultural Improvement Commission which had adopted M. George's conclusions regarding the necessity for special legislation in respect of grazing, based on the two following principles.

Compulsory limitation of the number of animals admitted into communal grazing grounds.

Equal division of the possibility among all the participating inhabitants.

M. Phal, Conservator at Chambère, the originator of this idea, justified his proposal before the Commission as follows:—
 "It is obvious to any one who has studied the Alps that the tendency of communal pastures to degradation owing to abuses is becoming greater and greater. In most of the communes of Savoy and l'Isère the management of the pastures has become a regular exploitation for the almost exclusive benefit of a few inhabitants who are fortunate enough to possess flocks, and who, for a generally very small tax, absorb the whole of the produce of the communal lands to the detriment of the rest of the inhabitants. These inhabitants have for the most part a considerable influence in the commune, and it is generally they who strenuously oppose every restorative measure from fear of seeing the area which they exploit diminished. It is quite a different matter when their own personal properties are concerned; these are managed with the greatest care, and form, as it were, oases in the midst of the communal desert.

It may, in fact be said that the communal pastures are exploited almost exclusively by a few large proprietors of flocks without the other members of the community deriving therefrom the least advantage. This is the reason to which may be chiefly attributed the check the proposed grazing regulations have received in the communes concerned. No project has been allowed to develop, for the simple reason that the large proprietors were for the most part the influential members of the Municipal Council. The same opposition would be met with now.

The first and only measure to take would be to modify the method of making use of the communal and mountain pastures. Grazing, like wood, should be allotted, each house should receive its fair share of the produce.

Suppose for example a certain mountain is capable of supporting, 1,000 sheep, and that the commune contains 100 houses, each house would have the right to graze 10 sheep. Conformably with the rules regarding wood, each member of the commune would have the option of making over the whole, or a part of his right to a third person.

In this manner the poor man as well as the well-to-do would have an equal and tangible interest in the preservation of the

communal pastures. "Such a measure would be essentially democratic, and I am convinced that its application would abolish a great number of difficulties and abuses."

M. Campardon, Forest Officer at Saint Giron, gave a similar account of the state of affairs in the Pyrenees.

In 1897, M. Guenot, who is not forest official and who knows the Pyrenees well, described the situation there before the Congress at Saint Nazaire in clear and forcible language. He concluded by saying that for centuries the pastoral population had done immeasurable damage to the mountain slopes. "It is high time that other interested persons, the people of the plains should make their voice heard and demand protection and security for their properties and their persons, both of which are compromised by the destruction of the mountain slopes. It will be impossible to tolerate much longer the present state of affairs. Any private individual who managed his property in the unreasonable way in which the country manages its mountains, would be considered an irresponsible lunatic and would have the management of his affairs taken away from him."

Thus, in the Pyrenees as in the Alps, the private interests of a few, sometimes even only one, two, or three individuals, have always been able to override the interests of the public.

A letter addressed to the Sub-Prefect of Briançon by the Municipal Council of La Roche (Alps) and dated August 1853, is reproduced in full in evidence of the extent to which the pastures, &c., were made use of at that time. The letter is an appeal for the abolition of certain rules issued by the Prefect reducing the number of animals each head of a family was entitled to graze, to eleven sheep and one goat. The object of this limitation by the Prefect was obviously to satisfy the wants of all. This, however, did not suit the petitioners, as there being about 200 houses in the commune the number of sheep and goat admissible under this rule would have been reduced to about 2,200 and 200, respectively.

Had the grazing been allotted from that time, the communal lands of La Roche would now have been husbanded for half a century and the same would have been the case in a large number of the communes of the French Alps. But the best intentioned Prefects have been unable to bring this about and the leading men of each commune have continued to overcrowd the pasture lands, and the State is now endeavouring, at considerable expense, to repair the damage done.

Everyone knows how the allotment of the wood of an ordinary annual coupe of the communal forest is made to the inhabitants. The general rule is to divide the timber and fuel by house, that is, by each head of a family or actual domicile existing in the commune before the publication of the allotment roster for the year. Formerly the timber was distributed among the inhabitants according to local usage. In the East, for example, the custom

was to distribute the timber in proportion to the covered surface of the houses.

It is easy to understand that such a method of distribution originated at a time when the trade in wood practically did not exist and timber was not of much more value than fuel.

With the development of means of transport, the price of timber increased enormously, and with the progress of ideas of equality, unequal allotment became insupportable and the law of 23rd November 1893 settled the matter easily and simply by generalizing the distribution per dwelling.

No doubt, similar modifications have taken place in the condition as well as in the methods of enjoyment of the communal pastures as in the case of the forests. It is certainly probable that in the last century the inhabitants possessed very different sized flocks and grazed, some of them perhaps five, and others five hundred head. There was no doubt grass enough for all; but during the present century the deterioration of the land has gone on increasing progressively. Unequal enjoyment has increased to the benefit of the rich proprietors; to the animals maintained throughout the year they have added those kept for trade purposes, with the result that the pastures are overcrowded to the ruin of the mountain slopes and injury of the common right as well as public interests.

One might ask how it is that the mass of the inhabitants have submitted to such an iniquitous state of affairs for so long. In the case of the people of Briançon they seem to have become so accustomed to malversations and extortions of various kinds that they regard them as inevitable and put up with them, as the Turks might do, under the influence of a sort of fatalism. There is no lack of examples showing this to be the case. One of these is given at length and relates how a forest guard, in return for bribes or other favours received, allowed people to steal wood from the communal forest. For a long time, by the connivance of the guard, the offences escaped detection and finally the guard was prosecuted under Section 6 of the Forest Code, which makes him responsible for offences in his beat which are not brought to notice. The Mayor of the commune, consulted as to the conduct of the guard, replied by four pages of eulogy on the excellent qualities of this official. The prosecution, however, took place, and the guard having absconded, was convicted in default. Once the commune was relieved of the presence of this rascal, every one was only too eager to come forward with accounts of his misdoings, and the same Mayor referred to above wrote to the Forest Officer to thank him for having removed such a scourge from the commune. Both these letters are on record.

There is no reason to suppose that the inhabitants of other communes are much different, and it is hardly to be expected that such people will undertake their own defence and insist on their right in the matter of pasturage. If they wished to do so, the

matter is very simple; they have only to elect a Municipal Council capable of voting, for equal allotment per house or per inhabitant. In any case, as it is a matter of public interest, the State should intervene and it is perfectly easy for it to do so.

There is not quite the same reason for regulating the enjoyment of the pasture per dwelling as there is in the case of the right to wood. The essential object of the pasturage is to supply food and clothing by means of the animals grazed, and it is more natural, therefore, to regulate the exercise of the right by the individual than by the dwelling house. It would be only fair that each inhabitant should have the same right to pasture, and once such a system were made legal, the people would be only too glad to see it enforced.

The present state of affairs, where only one or two individuals are interested in the pastures and these only to make all the use of them they can, is a hopeless barrier to all measures of improvement.

A common interest would be much less obstructive, for with equal rights every one would realize that any expenditure on works of improvement or preservation would be to the equal benefit of all, and with an intelligent Mayor, interested in the welfare of the commune, the restoration of the pasture lands would be possible. If there are any communes where the pastures are not overcrowded, anyone who took the trouble to enquire would without doubt find that the right to pasture is exercised fairly equally by all the inhabitants.

In this respect the example afforded by the communal forests is instructive. The greater majority of them are in good order, and if there are cases where half a century ago there was disorder and ruin, it was in those communes where the inhabitants helped themselves, or at any rate exercised unequal rights to wood, pasturage, or other produce. Under the protection of the system of equal rights for all, the forests prosper and the commune accepts successive measures of improvement, working plans, increased rotations, efficient protection and so on. It is [not once nor altogether that the communes consent to expenditure and economies on account of their forests, it is successively and generally by force of the example furnished by one or two, whose Municipalities are endeavouring to do their best for their forests with the aid of the Forest Department.

M. Broillard concludes his portion of the article by an appeal to M. Cardot to add his opinion in support of the question of equal allotment.

M. Cardot then continues the article in Part III. He commences by expressing a doubt as to the possibility of limiting the number of animals grazed without, at the same time making some endeavour to assure a production in accordance with the requirements of the inhabitants.

M. Cardot also doubts whether the mere limitation of the number of animals would be sufficient to bring the pastures into

a satisfactory condition. He maintains that it is not only the excessive numbers of animals grazed, but the total absence of all measures of protection that has led to the present deplorable state of affairs.

There are always natural causes of deterioration at work in the hills. In one place a landslip or avalanche covers the pasture with stones ; at another point the soil is eroded, and if nothing is done to prevent it, it will in time be cut away into a ravine by the water. Whatever the cause of the deterioration of the grass land, the cattle become more and more concentrated on those parts which have escaped, thus accelerating the ruin of the whole. A time eventually comes when the area is no longer capable of supporting the flocks, and if these are the only resource of the inhabitants they must emigrate.

An example is quoted of a certain village in the Hautes Alps in reference to which the writer, noticing the denudation which was going on all around it, remarked that "should he return that way in twenty years, he would hardly expect to find the village there then " Within five years the inhabitants had negotiated the sale of all their lands to the Forest Department and at present the only house now existing there is the Forest House, and tree growth is now beginning to repair the damage done by man's carelessness and excessive grazing. Mountain grazing-lands require care and repairs very much the same as a house does, if either are neglected for a long time ruin results, whereas by judicious repairs the damage can be prevented. It is, however, the common property of all such communal lands to be cared for by no one and to become less and less capable of satisfying the wants of all.

Restriction of grazing is not always sufficient to protect a disafforested hill from deterioration, due in great measure to the development of natural causes, nor yet to save the inhabitants from the cruel necessity of emigration. A law to prevent abuses is no doubt required, but this must also be supplemented by legislative and administrative measures capable of ensuring the carrying out of such works of restoration and maintenance as may be required.

The Agricultural and Sylvicultural Improvements Commission has already rendered signal service to the country in proclaiming the principle of allotment of pasturage. It remains for it to complete its patriotic work by indicating to the proper authorities and to Parliament the measures which ought to be taken to secure the carrying out in the pasture lands such works as are necessary to ensure for the mountains and their inhabitants the benefits of Pastoral Culture.

The immensity of the task need be no deterrent. The work of reboisement and the correction of torrents appeared sufficiently difficult when the law of 1860 was first applied, yet neither difficulties nor expense have proved an obstacle in this

case. Is it any more difficult to re-establish grass where damaged, than it is to create a forest on denuded moving slopes? Is it more difficult to prevent the formation of ravines where this threatens, than to fix the beds of those ravines which are the outlets of the reboisement areas? Is it any less useful, in short, to re-habilitate lands still capable of production, than to consolidate ruined slopes? The reply to these questions is clear and it is time to consider what measures should be taken to ensure the desired result.

M. Cardot after mentioning the possibilities of utilizing the Forest Department to help in the work of restoration, then discusses the question of expense, and concludes by comparing France of the present day with the lavish luxury of Paris, to a castle with a brilliant drawing-room in which to receive its guests, and a tottering, tileless roof, supported by cracking, decrepit walls, and asks whether it is not time that some of the golden sap which congests Paris to such an extent as to give it brain maladies from which every one suffers, should be diverted into the province.

Finally he calls on the Commission to prepare a complete project of legislation as the "Régime pastoral" in doing which he states it will have prepared the way for one of the most important and fertile of all agricultural improvements.

Life-history of the "Tun twig borer," *Magiria robusta*.

Early in July 1898, when the time arrived for the collection of tun seed, it was discovered that the bunches of fruits on the tun trees at Changa Manga were covered with a spider-web-like silken mass and that the fruits contained no seed, consisting of mere empty shells, each with a round hole in it, the inside having been completely devoured. Entangled amongst the web were reddish-coloured excreta, similar to that of a lepidopterous insect. No living larvæ were to be found, but a few empty chrysalis cases were found entangled in the web of the trunks of the trees.

On September 19th it was brought to my notice that the shoots of a clump of tun coppice had turned brown and were dead. These shoots were examined and it was found that they were hollow, the whole of the pith having been eaten, which had caused the shoots to wither. By splitting the shoots the culprit was found, namely a lepidopterous larva, about one inch long, bluish in colour with black spots and with short stiff hairs. A number of pupæ were also found in the larval burrows, enclosed in a dense white closely-fitting cocoon. I was informed at the

time that this damage was only found on the coppice shoots; but further examination showed that almost every young tún plant recently planted out was attacked in a similar manner. Even shoots on the large tún trees were also attacked in this way but it was the young plants which had chiefly suffered.

The attack always appeared to commence from the axil of a leaf, the young larvæ evidently having devoured the young bud and entered the shoot at the weak spot, from which a mass of gummy substance had exuded. Terminal shoots destroyed, were often over a foot in length. This is serious damage to young plants, as it leads to the trees being forked, and renders it almost impossible to obtain clean straight stems of any height.

A number of larvæ and pupæ were collected. The first moths appeared on 16th October, having been about a fortnight in the pupal state.

Remembering that tún fruit had been found destroyed in July last year, search was made early in the spring to try and find out the cause. On April 24th, 1899, the unripe fruits were examined, and it was found that they were already attacked and the culprit was discovered in a green unripe fruit, which it had entered by making a round hole from the outside. The culprit was a lepidopterous larva and was identified as being the same as that found in September in the tún shoots.

On other trees, which were still in flower, numbers of young larvæ were found on the inflorescences and were feeding on the petals of the flowers and young fruits. The young fruits were eaten bodily; but older fruits, whose outside had become harder, were burrowed into and the contents devoured, leaving nothing but an empty shell with a round hole in it. Having devoured the contents of one fruit, the larvæ leave it and attack another one in the same way. The inflorescences were covered with silken threads, in which were entangled excreta and pieces of partly-eaten petals.

By May 1st, the larvæ were more or less fully grown and were to be found in swarms, on the trunks of the trees, and appeared to be searching for suitable places for pupating. The trunks of the trees were covered with a dense mass of silken threads. A search was made for pupæ, but none were found. A number of larvæ were collected and by 29th April most had pupated. The first lot of moths appeared on May 6th, the pupal state having only lasted one week; and by May 15th all the pupæ had changed to moths. A few cases were also found in which tún shoots had been tunnelled into, and with larvæ in them, but this appeared to be very unusual, and was only confined to cases where no flowers or fruits had been produced on the plants.

Search was made for pupæ on the trunks of the trees, where I felt convinced they would be found, but no pupæ could

be discovered, which puzzled me very much. One day, however, May 27th, I stripped off some pieces of bark, and then the pupæ were discovered in masses, packed closely together. They were quite invisible from the outside, being right underneath the pieces of peeling bark. The pupæ were enclosed in white cocoons, similar to those found in tún shoots.

At the beginning of August it was found that larvæ had commenced to attack the tún shoots, and this completed the life-history. From the above, it will be seen that there are two generations of the insect during the twelve months, as follows.

1st Generation.

Larvæ.—Appear at the beginning of April as soon as the tún trees come into flower, continuing until about the middle of May and feeding on petals, young fruits and ovules of the tún tree.

Pupæ.—This stage lasts during latter half of May. The pupæ are red in colour, about $\frac{3}{4}$ in. long, and are enclosed in a dense closely-fitting silken cocoon and are found packed closely together in colonies underneath the peeling bark of main stems.

Imago.—The moths emerge from the pupæ at the end of May and are to be found throughout June and July.

Eggs.—Not found; but are no doubt laid on leaves or stems of tún plants.

2nd Generation.

Larvæ.—Appear at beginning of August and continue in larval state until end of September. They tunnel into young succulent shoots of tún plants devouring the pith, which causes the shoot to wither.

Pupæ.—This stage lasts during first half of October. The pupæ are enclosed in cocoons similar to the above, and are found in the larval burrows in the terminal shoots.

Imago.—The moths emerge from pupæ about the middle of October. It is not known how long they live or when the eggs are laid. As the tún tree loses its leaves at beginning of November, the eggs are either laid on the stems of tún trees and lie dormant throughout the winter, hatching into larvæ at beginning of April, or else the moths live through the cold weather and lay their eggs very early in the spring as soon as the young leaves of the tún tree begin to appear. The former is probably the more likely.

The larvæ of both generations are very destructive and attack and destroy, in each case, the most tender portions of the tún tree. In the 1st generation the tender petals, young fruits and ovules are destroyed, and in the 2nd generation the larvæ devour the pith of the youngest succulent shoots, causing them to wither.

Remedy.—On a large scale little can be done against this pest; but where young plantations exist, much good can be done by cutting back the attacked shoots carefully above a bud, at about the middle of September or just before the larvæ pupate. The shoots containing the larvæ should be burnt to destroy the larvæ. The bud below the cut will develop and produce a shoot which will replace the old terminal shoot, and it will have the whole of April, May, June and July in which to put on growth before it is likely to be again attacked. Tun grows rapidly and in a few years attains a good height, after which the damage is of no great consequence, as it is confined to branches, which will no longer affect the bole. During the first generation a great many larvæ might be destroyed by collecting them from trunks of trees, about the beginning of May before they pupate, or pupæ could be collected and destroyed by peeling off the pieces of bark containing them and burning them. In any case if timber trees are required, it will be necessary to prune them, otherwise the boles are forked very low down.

The following diagram shows the life-history in a convenient form.

Year.	Jan'y	Feb	March	April	May.	June.	July.	Augt.	Sept.	Oct.	Nov.	Dec.
1898				---	●+	++	+++	---		●●	+++	++++
1899	++++	++++	++++	---				---				

† = imago or moth; + = imago and egg stage; — = larval stage; = Pupal stage;

■ denotes period during which insect is destructive.

The egg stage and duration of the imago stage in the second generation is doubtful. The larva when young has a reddish tinge with black spots, but when mature is a distinct blue colour with the black spots. It is about one inch long when mature and rather fat. The head is black and the body is clothed with short hairs. The moth is brown with black marks on the veins, which are not very conspicuous and has a pearly lustre. It is about one inch across the wings. The insect is described on pages 122 and 123 of Mr. E. P. Stebbing's book on Injurious Insects of Indian forests and is figured on plate VIII of the same book.

12th August 1899.

B. O. COVENTRY.

II.—CORRESPONDENCE.

Royal Society's International Catalogue of Scientific Literature.

I beg to advise the despatch of a copy of a paper by me, published in the August Proceedings of the Asiatic Society of Bengal, and giving an account of the Royal Society's scheme for an International Catalogue of Scientific Literature.

As the scheme will work to the interests of those amongst your subscribers who publish original scientific papers, I would suggest that the same or a similar account of the scheme be published in your Journal. The Committee would be obliged also if you could obtain from the authors of scientific papers published in your Journal, a "primary slip" prepared along the lines indicated in the paper which I send you.

ASIATIC SOCIETY OF BENGAL,
57, PARK STREET,
Calcutta, 23rd August, 1899.

T. H. HOLLAND.
*Hon'y Secy. Committee of Control
of the Regional Bureau for India
and Ceylon.*

From the Proceedings, Asiatic Society of Bengal for August, 1899.

The Royal Society's scheme for an International Catalogue of Scientific Literature. By the Honorary Secretary of the Committee of Control, Regional Bureau for India and Ceylon.

I. ORIGIN AND OUTLINE OF THE SCHEME.

At an International Conference organized by the Royal Society, and held in London during July 1896, it was considered "desirable to compile and publish, by means of some international organisation, a complete catalogue of scientific literature, arranged according both to subject matter and to authors' names," in order that scientific investigators, by means of the catalogue, may be able readily to find out what has been published concerning any particular subject of enquiry.

In the following November a Committee was appointed by the Royal Society of London to study all the questions involved, and to frame a scheme for the work. The report of this Committee was issued on the 30th March, 1898, and during the following October a second International Conference was held in London to discuss the proposals of the Committee,

This Conference, which included delegates from Austria, Belgium, France, Germany, Hungary, Japan, Mexico, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States, Cape Colony, India, Natal, New Zealand and Queensland, confirmed the general principle of the previous Committee, that a catalogue be published in the form of separate cards for each paper as well as periodically classified in book form. It was decided to provide schedules for the internal classification of each of the following seventeen sciences:—

Mathematics.

Astronomy.

Meteorology.

Physics.

Crystallography.

Chemistry.

Mineralogy.

Geology (including Petrology).

Geography—Mathematical and Physical.

Palæontology.

Anatomy.

Zoology.

Botany.

Physiology (including Pharmacology and Experimental Pathology.)

Bacteriology.

Psychology.

Anthropology.

Each of these subjects will be distinguished by a separate *registration letter* and the subdivisions indicated in the schedules by *registration numbers* designed purely for the guidance of the Central Bureau in arranging the cards in order for the compilation of a book subject catalogue.

Card Catalogue:—The basis of this catalogue is the card or slip. For every communication containing scientific statements worthy of being indexed, whether appearing in a periodical or any other form of independent publication, at least one separate slip is to be prepared. These will be issued regularly to subscribers and will enable them not only to keep themselves informed as to the progress of a science, but also easily to keep an "account current" of such progress.

Book Catalogue:—At determined regular intervals, not necessarily the same for all sciences, the Central Bureau in London will compile from the slips and issue in a book form an index to authors as well as an index to the subjects treated in the literature published within the determined period. The book-catalogue will be obtainable in parts corresponding to the several sciences for which slips are provided, and in some cases, in Zoology for example, it may be found desirable to issue separate volumes for special sections of the subject. It is proposed also to supplement

this frequent periodical publication of book-catalogues by issuing collective indices covering periods of at least five or ten years. The titles of the publications and the subject entries will appear either in English, French, German, Italian or Latin, and the titles of publications appearing in other languages will be translated into one of these five for the purpose of indexing, but the original title will be preserved and issued with the translation.

The final schedule of classification for each subject is now being worked out by an International Committee, which was appointed by the 1898 Conference for the purpose, but the schedules proposed by the Royal Society's Committee, whose work closed on March 30th of last year, may be taken as example of the way in which the subjects will be sub-divided and catalogued.

As an example, the schedule proposed for subject F, Chemistry, is given at the end of this note and shows the elaborate system of classification which will enable the worker in any special branch to readily obtain the current literature bearing on his researches.

Where the different subjects overlap one another arrangements will be made, as much as possible, for similarity of numbering. Thus, in the case of Palæontology a publication will be numbered according to the system used in Geology for the stratigraphical horizon of the fossils referred to, according to the Zoological and Botanical systems to indicate their position in the animal or vegetable kingdom, and according to the scheme for Geography to show the country in which the specimens were found. A paper for instance, on Cretaceous Fishes from Asiatic Turkey would bear the symbol, K75, 14*e*; K standing for Palæontology; 75, the number for Cretaceous in the Geological schedule; 14 that for fishes in the Zoological; *e* for Asia and *i* for Asiatic Turkey and Arabia.

The systems of classification above for Chemistry and for Palæontology are sufficient to show the immense value the catalogues will be to special workers, who, under present circumstances, have no certain means of readily discovering the whole of the current literature bearing on their particular lines of research.

II. THE FORMATION OF REGIONAL BUREAUX.

The Royal Society's Committee, by enquiry of experts in the various subjects, estimated that the number of communications to be analysed and indexed would not fall far short of 40,000 in each year. To deal with such a body of literature, according to the detailed scheme indicated above, would, naturally, be beyond the powers of any one unaided Society, and the formation of Regional Bureaux was consequently undertaken.

The term *Regional Bureau* is introduced to indicate an organisation, wherever established, for the purpose of collecting and indexing the scientific literature of a particular region. The

region may be either a country or part of a country, or several countries or parts of countries which can for this particular purpose be conveniently grouped together.

It is proposed that such Regional Bureaux shall be entrusted with the task of preparing the slips required to completely index the scientific literature of the regions committed to their charge. The slips so prepared in the different regions will be regularly forwarded to the Central Bureau in London, to be checked according to the sanctioned schedules, and then printed, first in slip form and finally in book form for issue to the subscribers.

Primary slips :—The slips forwarded to the Central Bureau from each region will be known as *primary slips*, and when these bear more than one registration letter, or more than one subject-entry (indicating that more than one subject is treated in the publication it refers to), copies will be printed with or without alteration in the arrangement of the subject-entries, to permit the production of a full card catalogue for each subject. Such copies of the primary slip will be known as *secondary slips* and will be prepared entirely in the Central Bureau.

The Regional Bureaux will be responsible merely for the preparation of the primary slips, each of which is to contain :—

- (i) *A Title entry*—giving the author's name and the full title of the communication, in the original language alone if the language be either English, French, German, Italian or Latin. In the case of other languages, the title will be, as far as the Regional Bureau for India and Ceylon is concerned, translated into English ; but the original title will also be added, either in the original script, or transliterated into Roman script. The title will be followed by every necessary reference, including the year of publication, and such other symbols as may be determined. In the case of a separately published book, the place and year of publication, and the number of pages, &c., will be given.
- (ii) *Subject-entries*—indicating as briefly as possible the principal subjects to which the communication refers. Such subject-entries will be given only in the original language of the communication if this be one of the five previously referred to, but in other cases in India and Ceylon, English will be used.

The following specimens of primary slips prepared by the Royal Society's Committee will serve as a guide to Authors, who, it is hoped, will assist the local committee in their preparation :—

Specimen Primary Slips.

Mineralogy.

FOOTE, H. W. On the occurrence of Pollucite, Columbite, and Microlite at Rumford, Maine. *Am. Journ. Sci.*, 1896

G

(iv), 1,457 *Pollucite*. From Rumford, Maine. Anal.
Mangano-columbite. From Rumford, Maine. Cryst.
Columbite. Mangano-columbite, from Rumford, Maine. Cryst.
Microlite. From Rumford, Maine.
Rumford (Maine). Pollucite, &c.

Zoology.

L.

WINTON, W. E. de. Remarks on the existing forms of Giraffe. P. Zool Soc. London, 1897, pp. 273-283.

[*Mamalia, Artiodactyla Giraffidae.*]

Giraffa, specific characters, figg; synonymy

Means of defence, use and origin of horns

Africa, distribution in

III. THE REGIONAL BUREAU FOR INDIA AND CEYLON.

The Asiatic Society of Bengal, recognising the immense value of the scheme to workers in this country, readily acceded to the request of the Royal Society and undertook the formation and conduct of a Regional Bureau for India and Ceylon. The Governments of India and Ceylon have been addressed on the subject, and, in addition to an annual grant sanctioned by the former Government to cover office expenses, they have directed all heads of Government Departments issuing publications on subjects included in the Royal Society's list, to supply the Asiatic Society with primary slips of the kind described above; they have also instructed Local Governments and Administrations to supply periodical lists of books and journals published within their jurisdiction, with, as far as possible, copies of the publications.

A Committee has been appointed by the Asiatic Society to control the work of his Regional Bureau, and each subject defined by the Royal Society is represented on the Committee by a specialist, who will be responsible for checking or supplementing the primary slips relating to publications in his particular subject.

To Authors :—But as there are some fifty periodicals to be examined, besides independently published works, the Committee feels that its self-imposed task will not be adequately carried out without the loyal assistance of authors themselves, who, naturally, can most rapidly and most accurately indicate the scope of their essays.

The working of this scheme will, moreover, be attended with certain advantages to the authors themselves; for the catalogues will be regularly printed and issued by the Royal Society to the subscribers, who will include, besides many of the chief workers in each science, the principal scientific institution and libraries in the world. In this way all scientific papers and books published in India will be brought to the notice of the scientific world and the present partial and unavoidable neglect of Indian publications will consequently no longer be possible. In fact, as far as the scientific world is concerned, work published in

India will now receive, as it should do, exactly the same notice as it would if published by a leading society in Europe.

The assistance which the Committee ask of authors of papers coming within the scope of the catalogue is the preparation of a "primary slip" for each paper, prepared as already indicated, and in a form similar to the two samples given above.

It is important to observe that what is required is not an index to the paper or book, but an index to the subject treated, and the entries for these should be as brief and as few as is consistent with the scope of the paper. The author is not asked to enter the registration letters and numbers; that will be done by the Bureau, but he is requested to make the subject-entries, and these should only be prepared for subjects which are so treated as to contain an addition or alteration to existing knowledge; subjects referred to merely as illustrations of the matters dealt with in the paper should not be indexed.

In the case of papers dealing with Paleontology, Zoology or Botany, the Primary Slip should contain a classified list of all new species described. If no new species are described the subject-entries should indicate the natural orders, families, or genera dealt with and the subject dealt with in relation to them.

Books or papers whose scope is completely or sufficiently indicated by the title will require no further subject-entries. Text books and educational works, whose scope is sufficiently indicated by their title, require no subject-entries, except where they may contain additions to the existing knowledge of science, when subject-entries should be prepared for these parts only.

The Committee of the Regional Bureau have drawn up a list of periodicals which are known by them to publish scientific papers, and which are received in the library of the Asiatic Society of Bengal; but they have to trust to the quarterly reports from Local Governments for intimation of the publication of independent books and pamphlets. As these quarterly reports may appear some considerable time after the publication of a book, it is desirable for authors, to ensure immediate record being made of their work, to send a copy to the Asiatic Society accompanied by a primary slip containing title and subject-entries. Societies and Editors are similarly recommended to adopt the very useful practice now being followed by many scientific societies in Europe of issuing primary slips with each "part" of a journal. Such slips can best be prepared by the authors themselves, and sent to the editor of the journal in which his paper appears, for transmission with the journal to the Asiatic Society of Bengal.

IV. CENTRAL ORGANISATION.

For the continuation and proper development of the work the Royal Society recommended, and the Conference held last October approved of, the organisation of *International Conventions* to be held in London in 1905, 1910 and every tenth year after-

wards. Such International Conventions will consist of delegates appointed to represent the various Regional Bureaux, for the purpose of revising as may be necessary the regulations for carrying out the work of the catalogue authorised by the International Conference of 1898.

It is also proposed to form an *International Council* composed of one member from each of the Regional Bureaux to act as a governing body of the catalogue. The reports of this Council, giving an account of the expenses of the scheme, will be distributed to the several Regional Bureaux and will be published in recognized local periodicals.

The International Council will appoint for each science an *International Committee of Referees* to decide on questions of classification not provided for by the catalogue regulations, or in cases of doubt to pronounce an opinion as to the meaning of the regulations.

The actual routine work connected with the classification of primary slips received from the different regions, and the printing and issue of the catalogues will be carried on in London by the *Central Bureau*, which will consist of a Director and staff of expert Assistants.

It is impossible yet to fix the rates of subscription to the catalogues, but the scheme drawn up by the Royal Society's Committee provides for subscriptions to the Slip Catalogue and the Book Catalogue separately, both of which will be issued in parts devoted to the whole of a registered science when its literature is limited in amount, or to a special section of a science when its literature is extensive and capable of convenient subdivision. The Regional Bureaux will, later on, be provided with the scale of subscription, when steps will be taken to inform individuals or institutions likely to subscribe.

The preparation of the catalogue will date from the 1st of January, 1900.

Abridged Schedule of Classification for Chemistry.*

Chemical Bibliography.

- 0000 Philosophy.
- 0010 History.
- 0020 Biography.
- 0030 Dictionaries, collected works, text-books.
- 0040 Pedagogy.
- 0050 Addresses, lectures, essays and theses.
- 0100 Chemistry (Specific) of the Elements, to include all entries relating to the elements generally, or which cannot be referred to any one of the known elements.
- 0110 Aluminium.
- 0120 Antimony.

* From the Report of the Royal Society's Committee, March 30th, 1898. The numbers employed to distinguish the sub-divisions are sufficiently separated to admit the interpolation of new sub-divisions as the subject expands.

0130 Argon, followed by the other known elements at similar numerical intervals and arranged in alphabetical order up to—

0840 Zirconium.

Entries made under any element may be further sub-divided according to the nature of the compounds in which they occur, and are arranged into five further sections in such order that the entries relating, *a*, to the history or origin of the substance shall come first, followed by, *b*, its preparation or manufacture; *c*, its structure, or theoretical nature; *d*, its interactions or use; and *e*, its compounds.

0900 Laboratory procedure.

1000 Organic (Carbon) Chemistry (Specific).

1010 Hydrocarbons generally with the following recognised groups—

1020 Paraffins.

1030 Unsaturated open chain hydrocarbons.

1040 Benzenoid hydrocarbons.

1050 Reduced benzenoid hydrocarbons (terpenes, &c.).

1060 Unclassified hydrocarbons.

When necessary these groups of hydrocarbons are further sub-divided into isologous groups, in each of which the compounds are entered in homologous order.

1100 Alcohols and Ethers with sub-divisions, as in the case of hydrocarbons ranging from 1110 to 1150.

1200 Acids.

1300 Aldehydes and Ketones.

1400 Carbohydrates; Glucosides; Resins.

1500 Amino-and Azo-compounds

1600 Mixed Cycloids.

1700 Organo-metallic and allied compounds.

1800 Alkaloids

1900 Proteids.

2000 Coloured compounds

2500 Operations in Organic Chemistry.

3000 Analytical Chemistry

3500 Theoretical and Physical Chemistry

4000 Physiological Chemistry.

The above are only the main sections proposed by the Committee; the sub-divisions between Nos. 1500 and 1600 (*Amino- and Azo-compounds*) will serve to exemplify the next stage of sub-division in the schedule—

1510 Amino-paraffins.

1520 Amino-derivatives of unsaturated open chain hydrocarbons

1530 Amino-derivatives of benzenoid hydrocarbons

1535 Amino-derivatives of reduced benzenoid hydrocarbons.

1540 Acid amides and allied compounds

1545 Imides, imido-ethers, &c.

1550 Azo-compounds (open chain)

1560 Azo-compounds (closed chain)

1570 Diazo-compounds (open chain)

1580 Diazo-compounds (closed chain).

1590 Unclassified amino and azo-compounds.

Each of the divisions 1570-1540 are sub-divided again into mono-amino, diamino, &c, derivatives, which are arranged as in other series.

The following is given as a specimen page of the subject-catalogue in Chemistry:—

Specimen Page of Subject Catalogue.

F. Chemistry.

0020 Chemical Bibliography.

Biography.

Baumann, Eugen, mit Bildnis und Verzeichniss seiner Schriften. *Kessel*, A. B., 1897, 3197, 3209.

Blomstrand, Christian, Wilhelm, *Klason Peter*, B., 1897, 3227-3241.

Kekulé memorial lecture, with portrait. *Japp*, F. R. Soc., 1895, 97-131.

St hman, Friedrich, mit Verzeichniss seiner Schriften. *Ostwald*, W., B., 1897, 3214-3222.

0040 Pedagogy.

Chapters on the aims and practice of teaching, edited by *Frederic Spencer*. Cambridge (England). At the University Press, 1897. Chap. X., Chemistry, by *Armstrong H. H.*, 222-259.

0100 Elements.

a Sur un nouvel extrait de la bauxite française, *Bayer*, R. S., Bl., 1894, 11, 1155.

Argon, a new constituent of the atmosphere. *B. O. Rayleigh Lord*, and *Ramsay*, W., Phil. Trans., 1895, 187-241.

0100 Aluminium.

b Amalgamirtes mit Wasser als neutralen Reduktionsmittel. *Wislicenus H.*, and *Kaufmann L. B.*, 1895, 1323, 1935.—*Cohen*, J. B. and *Ormandy R.*, Ibid., 1895.

Use of amalgamated, in preparing benzenoid hydrocarbons. *Hirst H. R.*, and *Cohen*, J. B., Soc. Pr., 1895, 148, Action sur le carbone et ses composés, *Frank L.*, Bl. 1894, 439.

C. Carburé, *Frank L.*, Bl., 1894, 445.

Gl. Krystallisation. *A. Dennis*, L. M.

c. Z. a. Ch., 1894, 339.

d. Avec du borneol, du camphre, et du camphre monochloré *Perrier*, G., C. r., 1894, 119, 276.

Avec les composés nitrés aromatique. *Perrier*, G., C. r., 1895, 120, 930.

O. Sur les carbonates, les hydrates et c. les phosphates. *Schlumberger*, N., Bl., 1895, 41.

f. Réduction par le charbon. *Moissan*, H., C. r., 1894, 119, 260.

Sl. Zur Chemie einiger Alumosilicate.

g. Einwirkung der Alkalien. *Thugutt & J.*, Jahrb. f. Min. Beil., 9, 554.

0390 Iodine.

k. Pure from Cuprous iodide. *Lean*, *Heran* and *Whitnough*, W. H., Soc., 1898, 148-157.

Cu. Cuprous iodide from iodoform. *Lean*, i. *Bryan*, and *Whitnough*, W. H., Soc., 1898, 153.

0510 Nitrogen.

Density of, from various sources. *Releigh*, *Lord*, and *Ramsay*, W., Ph Trans., 1895, 187.

Nitrosoverbindungen, Aliphatische. j.

k. *Piloty*, O. B., 1898, 452.

P Polymeric chloronitriles or phosphorus.

i. *Stokes*, N. H., Am. Chem. Journ., 1897, 782-795.

1010 Hydrocarbons

Petroleum, Composition of Californian. *Mayberry C. F.*, Am. Chem. Journ., 1897, 796.

1020. Paraffins.

m. propan, Brom-2 nitroso-2., aus Acetoxim und Brom. Identisch mit Brom-propylpseudonitrol. *Piloty*, O. B., 1898, 454 Octan-Ueber ein, Nitroso-. Dimethyl-2-5-nitroso 2. hexan. *Piloty*, O., and *Ruff*, O. B., 1898, 457.

1130 Benzenoid oils.

n. phenol, p-Amido-, und dessen Äther. Einwirkung des Oxalesters auf *Piutti*, A., and *Piccoli*, R., B., 1898, 330.

1230 Benzenoid Acids

Cinnamic and allied acids as a criterion of structure, Etherification of *Sudborough*, J. J. and *Lloyd*, L. L. Soc., 1898, 81-98.

1340 Closed chain ons.

o. Sulfonale cyclischer Ketone. Pentanon-Methylpentanon-, Methylhexanon, und Heptanonsulfonal. *Wallach*, O., and *Borsche* W., B., 1898, 339.

3500 Theoretical Chemistry.

Stereoisomerism as affecting formation of ethereal salts from unsaturated acids *Sudborough J J*, and *Lloyd L L* Soc., 1898, 81-96.

3550 Conditions of Chemical Change Moisture, Influence on production and stability of osone, and on interaction of mercury and halogens of. *Shroutens*, W. A. Soc., 1897, 71, 477-488.

Arboricultural Experiments.

It would be a great satisfaction to some who formerly worked in India, and perhaps not without use to others, if we occasionally heard of the present results of experiments which were started some years ago, and which it is difficult to believe have altogether died out and left no mark.

Among the experiments made to introduce particular trees and plants into India, many of course have been failures, and sometimes costly failures, because they were tried without the least *à priori* chance of success. We used to be sent wondrous bags of seeds in the Punjab, and told to make plantations of them. I recollect having been given a piece of wretched dry soil filled with old brick debris and saturated with sulphate of soda and being desired to plant it with the "Carob tree." Of course the thing failed the wonder being, that about half-a-dozen Carob trees were actually got to grow in places where water could be given ! But the dry climate of the Punjab plains will never allow the Carob to develop its fruit. Another experiment was, however, made with better prospects and that it would be extremely interesting to hear of, if any results have survived. It was known that the edible chestnut grew in Dehra Dun and the hills beyond, and an effort was made in the Sutlej valley (and I think in Kulu and elsewhere) to grow it, as the fruit would be a very real resource to the forest population during the long winters. I know that 20 years ago there were a few flourishing chestnut groves in Bussabir. Has the edible or 'Spanish' chestnut been at all successful ? Once more ; we tried the olive also. Even in the Punjab plains, the (South) French and Italian olive grew and flowered. In my garden, on alluvial and good soil in the older part of Lahore, I had a tree (I think from Italy or South France) which in February—March flowered freely and produced little olives, the size of a pea; but instead of developing, the hot winds of April—May dried them ; they turned yellow and fell off. We then conceived the idea that the tree would fruit in the lower hills, say Chamba or Kulu, where there is an indigenous, wild species, and in the Agri-Horticultural gardens at Lahore many indigenous olives were raised and grafted with the fruit-bearing species, and the plants were sent to the hills. Grafted plants imported direct from Europe were also obtained (from Messrs. Andrieux and Vilmorin) and sent to Kulu. Has any result been obtained ? An olive tree does not, I believe, fruit for several years, but what I speak of was done about 15 or 20 years ago.

We also introduced the English oak and beech and actually had some young trees at Kalatop forest (and elsewhere) near Dalhousie ; this was more for ornament than with the hope of economic utility, but it would be interesting to know whether any trees survive ? There used to be a tree of *Q. robur* (or *pedunculata*, I forget which) at Abbotabad in Hazara.

Oxford, August 1899.

B. H. BADEN-POWELL,

III.—OFFICIAL PAPERS & INTELLIGENCE.

The Punjab Land Preservation (*Chos*) Bill.

We are glad to learn that a Bill has been introduced in the Council of the Lieutenant-Governor of the Punjab enabling Government to deal with the torrents which for a long period have been laying waste the cultivated lands of the Hushiarpur district in yearly increasing areas. We reproduce below the Hon'ble Mr. Fanshawe's speech on introducing the Bill, as reported in the "Pioneer."

"The *Siwalik* Range, which extends along the north-east border of the Hushiarpur and Umballa districts, consists mainly of a soft sandy conformation remarkable for the absence of clay constituents. In consequence, where the range is not protected by a natural growth of grass, underwood and trees, it is liable to violent erosion by the heavy annual rainfall, which amounts to some 40 inches, and the sand *detritus* thus washed down is carried far into the plains and is the cause of most serious damage there. This damage is greatest in the Hushiarpur district, in which no less than 1,000 villages are affected; but it also extends to nearly 70 villages in Jullunder, and is not unknown in the Umballa district. The facts of the damage done in the first two districts during the last fifty years are as follows:—In 1852 the area affected by *chos* in Hushiarpur was slightly under 50,000 acres, and the area so affected in Jullunder was under 1,000 acres. At the last land-revenue settlement, fifteen years ago, these areas had risen to 80,000 acres, and they have now reached 100,000 acres, or just double the area affected at the middle of the century. Besides this, a further area of not much less than 20,000 acres in these districts has been so far injuriously affected by *chos* action as to require a reduction of assessment. It is obvious from these facts that the loss and suffering caused to the cultivators of the areas in question must have been very great, and that they call for a remedy if one can be reasonably supplied. If the loss to Government in the matter of land-revenue is put at one lakh of rupees only, the loss to the villagers must have been at least ten times that amount, and it has been ascertained that in the Hushiarpur district they are deeply involved in debt. The evil, moreover, has been, and is proceeding in a rapidly increasing ratio, as is always the case under such conditions as those of the Hushiarpur *Siwaliks*, and the measure of damage done in the past is no adequate test of that which will probably happen in the future. The principal reason why this natural evil has assumed such serious proportions during the last fifty years, is that, while previous to 1852, the waste lands of the *Siwaliks*, which were at that time well protected by trees and bushes and grass, were considered to belong to the State, and were

controlled by State servants: at the first regular settlement of Hushiarpur these lands were divided up among the villages in and adjoining the hills, and have since that time been treated as village common lands. The consequence of this and of the development of adjoining large villages and small towns in the plains has been that the grass and brushwood and trees on the hill side have been largely destroyed, and that the number of cattle and sheep and goats kept in the villages in the hills has increased beyond all reasonable limits; and it is certain that unless special legislative action is taken to check the evils in question, they will increase until a common ruin involves both the villages in the hills and the villages in the plains. The question of such action as regards the *chos* has been under consideration ever since 1876, when the necessity for it was first mooted by the Deputy Commissioner of Hushiarpur, Mr. Coldstream. A special report on the subject was prepared in 1879 by Mr. Baden-Powell, then Conservator of Forests in the Punjab, and another report was written in 1883 by Mr. Moir, Deputy Conservator of Forests, who had specially studied the question of the reclamation and protection of similar areas in the south of France. Since then the opinions of various experts, forest and revenue, have been recorded on various occasions to the effect that special measures ought to be adopted by the Government to prevent the growing evils of *chos* action. For a long time it was proposed to attack the evils which must be faced at the seat of their origin in the hills, as training works in the plains afford only a local remedy by passing the evils on elsewhere, by recourse to existing provisions of the Forest Act, but after full and detailed consideration of the matter during the last four years it has been decided that not only are these provisions inadequate to meet the very special circumstances of the *chos*, but that they would be rendered practically inoperative by the very large amount of compensation which would have to be paid under the terms of the Land Acquisition Act. In consequence, the present Bill has been submitted to the Government of India and has been approved by Her Majesty's Secretary of State for India; and, if, on the one hand, the Punjab Government can hardly be accused of precipitate action in this connection, it must be remembered, on the other hand, that a measure which purports to restrict the exercise of rights of long standing, properly demands long and useful consideration. The full title of the Bill is "A Bill to provide for the better preservation and protection of certain portions of the territories of the Punjab, situate within, or adjacent to, the *Sivalik* mountain range, or affected by, or liable to be affected by, the water of streams and torrents such as are commonly called *chos* flowing through, or from, or by, the debouement of forests within that range," and it is this Bill which I now ask the leave of the Council to introduce.

The procedure laid down in the Bill is as follows:—In the first place, Section 3 empowers the Local Government to issue a

notification in the *Punjab Gazette*, declaring that it is desirable to provide for the better preservation and protection of any particular area which is to be brought under the provisions of the Act, situated in, or adjacent to, the *Siwaliks* or affected by *cho* action. Thereupon any general orders issued under Section 4, and declared on issue to be applicable to all areas which may be notified, and any special orders which may be issued under Sections 4 and 5 with reference to the notified area in question, will come into force as regards such area. These orders will, under the provisions of Section 6, be published in the *Punjab Gazette*, and will state that Government is satisfied that the restrictions imposed by them are necessary; and a public notice of the effect of them will, under Section 8, be given by the Deputy Commissioner's orders, whether general or special, issued under clauses (a)—(c) of Section 4, are subject to strict limitations. So far as the cleaning and cultivating of land or the quarrying of stone and burning of lime are concerned, they cannot affect any action taken *before* the date of the notification, declaring the area in which these rights have been exercised to be a notified area; while as regards the cutting of trees and the removing of forest produce, they cannot affect anything which is done for the *bonâ fide* domestic or agricultural purposes of the inhabitants of the notified area. On the other hand the practices of firing the hill-sides and of grazing sheep and goats, which are the principal causes of the damage resulting from *cho*, and the prohibition of which will, in the opinion of many forest experts, be almost sufficient of itself to largely secure the reboisement of the now denuded hill-sides, can be absolutely forbidden under clauses (d) and (e) of Section 4. Clauses (f) and (g) of the same Section provide for the minor matters of granting permits for removing forest produce from the notified area, and the examination of produce so removed. Orders issued under Section 5 must in all cases be special and will be issued to meet special circumstances. They may restrict or prohibit the rights of breaking up and cultivating of land and the quarrying of stone and burning of lime, *though exercised before* the date of the declaration of the area to be a notified one—the rights to cut trees and take forest produce although for *bonâ fide* agricultural and domestic purposes—and the right of pasturing all cattle, and not merely sheep and goats. It may here be noted that the number of sheep and goats pastured in the Hushiarpur *Siwaliks* exceeds 50,000. The restriction of existing rights under Sections 4 and 5 is subject to the payment of compensation which is provided for in Sections 14 and 15 of the Bill; and the Deputy Commissioner will, therefore, publish the orders directing such restrictions in every town and village affected, and, in doing so, will warn all persons who claim compensation for the restriction of rights to appear before him within a fixed period, of not less than three months, to prove their claims. Sections 14 and 15 make, I think, it will be admitted, provisions

for a full and fair enquiry into such claims, and the amount of compensation awarded will, like all other orders of the Deputy Commissioner, with two small exceptions, be subject to appeal. So far the provisions of the Bill affect mainly notified areas within the *Sivaliks* or immediately at their feet ; but Section 9 empowers Government, for two specified purposes of protection, either to require the owners of a *cho* bed which is not cultivated nor culturable, to carry out these measures, or to declare, either in the first instance or upon the owners failing to comply with such requisition, the bed of the *cho* to be vested in Government for a term of years or in perpetuity without payment of any compensation. This provision has been inserted in the Bill because no land revenue is assessed on such *cho* beds and because it is generally impossible for a number of villagers, still more so for a number of villages, to combine to carry out works of protection which, if steadily persisted in, will often render portions of the land affected by the *cho* culturable. In most cases no doubt, the villagers would, in the first instance, be offered the opportunity of themselves reclaiming affected land in the *cho* bed ; and where this task is entirely beyond their powers they would probably be only too glad that the Government should undertake it, as even if their individual rights in the lands ultimately reclaimed are extinguished, such reclamation will be greatly to the benefit of the adjoining village lands, and the *cho* bed lands actually reclaimed would, if not restored on easy terms of repayment of the cost of reclamation to Government, be ordinarily leased no doubt to members of the village community for cultivation. The other provisions of the Bill may be lightly passed over at this stage. Section 13 gives the necessary power to Government officers to enter on the lands notified—under Sections 3 and 9, and Section 6 provides for the preparation of a due record of rights in all notified areas. The penalty imposed for the breach of any orders of the Local Government under Sections 4 and 5 is the usual one in such cases, namely, imprisonment which may extend to six months or fine, which may extend to Rs. 500, or both."

IV.—REVIEWS.

Forestry at the Cape.

The Reports of the Conservators of Forests at the Cape of Good Hope for 1896 and 1897 have been to hand for some time, but have been crowded out by pressure of other matter. They are naturally published a year later than the period they refer to.

There does not appear to be any Central authority on forest matters, the four Conservators, Western (or Cape Town) Midland, Eastern, and Transkei being severally, responsible to the Minister of the day or hour. Consequently, forest policy, though not the standing disgrace it is in Australia, is yet on a footing that is far from satisfactory to the well-wishers of the colony or creditable to the politicians who keep it so. There is also a Ranger for British Bechuanaland. There is no guarantee of permanence, either for the forest area or for the management thereof, and there is no want of "enterprise" to take every advantage of the weakness of the Department. Under these circumstances great credit is due to the Conservators, Messrs. Hutchins, Heywood, Lister, and Henkel for the excellent results they have already produced.

The forest area of the colony is extremely paltry, being 29 per cent. of the total area, and even this much is not assured from political and commercial attacks. A country like the Cape ought to have at least 25 per cent of its area under forest, and it is quite possible for this amount to be obtained without trenching on areas valuable for agriculture. In support of his statements as to the climatic benefits to be expected, Mr. Hutchins cites the well-authenticated case of the Santa Clara Valley in California, well-authenticated in spite of the former absence of rain gauges. The valley is 60 miles long and 12 miles wide. It contains no less than 6 millions of fruit trees, mostly 20 ft. apart, and is thus, if not quite a forest, still something very like it. The oldest inhabitants assert that the climate has changed. Those who may choose to assert that it has not, have to explain away the awkward fact that for many years at first the trees *could not be established without irrigation*, whereas at present *irrigation is rarely resorted to*. The rain fall is now about 22 inches.

The revenue of the various Conservatorships runs to about £22,000, and the expenditure to about £50,000. The profit, for it is profit, is mostly due to planting. There is good hope for a country that is stiff enough in the back to do this in spite of politics and commercial enterprise.

There is another good point about these reports, viz.; the whole basis and calculation of the Working Plan is fully explained, so that any one capable of understanding such matters can know what is being done and have the chance of criticising it.

Owing to the destruction of the indigenous forests, the Cape department finds itself under the disagreeable necessity of doing things it does not like; for instance, cutting up splendid timber-trees like yellow-wood for railway sleepers. This "yellow-wood" is almost the only common name of a tree that is not to be found in any of the lists given; possibly it is the same as "upright yellow-wood" or simply "upright" (*Podocarpus*

Thunbergii). At present, the colony has to send annually about a quarter of a million sterling out of the country for sleepers, which it is quite capable of producing on its own land, and would have been producing had ordinary care and foresight been exercised from the first. To meet the future demand for sleepers, &c., great plantings and sowings are going on, mostly of cluster pine (*P. Pinaster*) round Cape Town. Five or six tons of its seeds are used annually. Some hundreds of pounds worth of seeds are sold to the public at cost price, in order to encourage planting by farmers and others.

There is also a Planting Act, under which municipalities may spend money on planting and are reimbursed one-half the cost by Government. This system seems generally to work well, but the Cape Town Municipality would appear to have been wasting its own, and the Colony's money on the "penny-wise-pound-foolish" principle to such an extent as to call for interference. Municipalities in general are not unmixed blessings, and this one seems no exception. In the present case, the Cape Town water-supply is not all it might be, and will certainly have to be largely increased in the future. Accordingly, large plantations have been made on Table mountain, and the lower portion thereof was mostly afforested, when the Town Council influenced the Minister of Agriculture so that further planting was stopped. Some crank or cranks had alleged that tree-planting was not favourable to water conservancy. It may be remembered that there were not wanting wiseacres who said the same about the Bombay water-supply at Tansa. It is evident that impounded surface water cannot be as clear and pure as spring water, and the Table mountain water seems to be brownish, but far worse is the water from George and other sources of supply that are on open land. There are, however, solid facts bearing on the case. The "Silver" river near George was so called from its former crystal quality. Since the forest was destroyed, it has become brown and repulsive-looking. The Swart, Kaimans, Touw and other rivers now run with discoloured water, rise and fall rapidly, and run nearly dry in the hot weather, all this since the forest disappeared. As one travels further to the Glebe river at Knysna and westward to the Storms river, the forest is still standing and the rivers run crystal.

Among the most remarkable points discussed in the Reports must certainly be considered the experiments on the rate of growth of cluster pine (*P. pinaster*), stone pine (*P. pinea*) and blue gum (*Eucalyptus globulus*). At Plumstead, as representing a good average of the Cape Flats, two determinations have been made. Mr. W. N. Brown made the annual acre-increment to be 380 cft. This was so large that Mr. Hutchins made fresh measurements, and arrived at 342 cft., which certainly appears little less than marvellous. The figures are worth quoting:—

Area measured .212 acres aged 14 years

Stock 311 trees = 1467 trees per acre

Total stock on area = $1737\cdot06$ (ideal cylinder-contents) $\times 0\cdot65$
(form factor) = 1129 09 cft.

Stock per acre = $1129\cdot09$ cft. $\div \cdot212 = 5325\cdot89$ cft.

Yearly increment of average tree = $1129\cdot09 \div 311 \div 14$
= $\cdot26$ cft.

Yearly acre-increment = $5325\cdot89 \div 14 = 380\cdot42$ cft.

Do do in tons = $\frac{380\cdot42 \times 66\cdot53 \text{ (sp gravity)}}{2240}$

= 11.30 tons green wood.

or $\frac{380\cdot42 \times 36\cdot06 \text{ (sp. gravity)}}{2240} = 6\cdot12$ tons dry wood.

The specific gravity of wet wood was got by cutting and weighing 6 logs, each 4 ft. long. The weight was 265 lbs. The mean diameters were taken and gave a mean sectional area of $\cdot995724$ sq. ft. equal to $3\cdot982896$ cft. Whence sp. gravity
= $\frac{265}{3983} = 66\cdot53$ lbs. per cft.

The specific gravity of dry wood was obtained from the mean of two old and well sea-oned specimens, and found to be $36\cdot06$.

The form factor was obtained by felling 22 trees, taking their girth, height and weight. The cubic contents were obtained from the weight divided by the specific gravity = $\frac{3756}{66\cdot53}$
= 56.56 cft.

Hence form factor results from $\frac{56\cdot56}{86\cdot92 \text{ (ideal cylinder)}} = \cdot65$

The blue gum (*E. globulus*) in the Ceres Road plantation gave similarly good results, the figures being as follows:—

Area 1 acre, 11 years old, planted 5 by 5 ft.

No of trees 466, containing $3545\cdot66$ cft.

Annual acre-increment = $322\cdot33$ cft. = 5 75 tons of 56 cft.

Average annual individual increment = $\cdot69182$ cft.

Ideal cylinder-volume = 7402 23

Form factor obtained from 20 trees = 479.

Actual stock = $7402\cdot23 \times \cdot479 = 3545\cdot66$ cft.

Annual acre-increment = $\frac{3545\cdot66}{11} = 322\cdot33$

Specific gravity = 70.08 lbs per cft. green.

The above acre-increment is considered to be only fair growth for blue gum.

The acre-increment given by the whole of the first crop at Worcester (Cape plantation was as 332 cft. per annum. The coppice regrowth at the age of 5 years gave an acre-increment of 457 cft.

The Stone pine on a farm at Somerset West, calculated as above at the age of 42 years gave an annual acre-increment of 249.9 cft. timber = 7.1 tons

50.7 cft. firewood = 1.48 tons,

A good deal of drift-sand embankment work is in hand, for instance on the shores of False Bay, where a coast dune similar to that of the Gascon Lunds is in process of creation. The grass called Marram (*Ammophila arundinacea*), used in France and Pyp grass (*Ehrharta gigantea*) together with wattles and certain native plants are used for the purpose. The Marram grass appears to be a failure at Port Elizabeth, and may not succeed at False Bay, where the temperature is higher and the rainfall less than in Gascony. Pyp grass seems to be the hardier of the two. The Eerste river reclamation has been abandoned on the score of cost, though the work was quite successful. The Railway used to carry about 1,500 truck-loads annually for a distance of 18 (?) miles at $\frac{1}{2}d$ per ton-mile. The doubling of this rate led to the stoppage, and though the Railway was willing to revert to the old conditions, it has been decided that there is better work to be done than to spend £10 per acre on creating land that will, with a rainfall of 15 inches, not be worth more than 10 shillings per acre. At False Bay, the grass is planted 2 ft. apart in rows 6 ft. apart at a cost of £3 11s 7d. per acre in some cases, in others it only costs 25 to 30 shillings, plus fencing, if necessary, in each case. Wire fencing here costs about £4 per acre. The system of disposing of town refuse by fixing loose sands with it is a most excellent one, killing two birds with one stone. Unfortunately the cost of carriage soon comes in as a limiting factor. The refuse itself apparently costs about 10 shillings per truck (at Eerste river at any rate) and its distribution on the ground may cost as much or more. There is a large number of plantations and an immense amount of work is being done in sowing and planting. With them, kerosine tins, tarred for preservation, seem to occupy the place of our basket-planting, and give great satisfaction. They also prepare nursery beds by making a solid bed of cement, concrete, gravel or clay, on which the nursery soil is spread to the depth of a foot or so.

Insects and plant diseases sometimes cause great havoc, for instance in the Stone pine, in *Aracia melanoxylon* which was nearly exterminated 20 years ago by the Dorthesia pest, and therefore cannot be grown pure, &c., &c. This *A. melanoxylon* is what they call blackwood. Indigenous to Australia, its shade-bearing qualities allow it to be now used at the Cape for underplanting and interplanting sparsely stocked areas. In the Nilgiris it could not be grown pure on account of a *Loranthus* parasite.

The following list of indigenous or imported trees may be useful for the purpose of collocating the common and scientific names of a few of the more important species now grown at the Cape.

Botanical name.	Common Name.
<i>Aberia caffra</i> .	Kei apple.
<i>Acacia dealbata</i> .	Silver wattle.
" <i>decurrens</i> .	Black "
" <i>melanoxylon</i> .	Blackwood.
<i>Apodytes dimidiata</i> .	White pear.
<i>Callitris arborea</i> .	Clanwilliam cedar.
<i>Curtisia faginea</i> .	Assegai.
<i>Elæodendron croceum</i> .	Safraan.
<i>Eucalyptus globulus</i> .	Blue gum.
" <i>diversicolor</i>	Karri.
" <i>marginata</i> .	Jarrah.
<i>Gardenia Rothmannia</i> .	Kaarshout (of the Transkei.)
<i>Ocotea bullata</i> .	Stink-wood.
<i>Olea laurifolia</i> .	Black ironwood.
" <i>verrucosa</i> ?	White "
<i>Pinus Pinaster</i> .	Cluster Pine.
" <i>pinæa</i> .	Stone "
<i>Podocarpus Thunbergii</i> .	Upright Yellowwood.
" <i>elongata</i> .	Onteinqua "
<i>Pterocelastrus variabilis</i> .	Kersehout.
<i>Pteroxylon utile</i> .	Sneezewood.
?	Kamassi or Cape or S. African Boxwood.

Of the above, the Clanwilliam cedar, sneezewood, stinkwood and yellow-wood are those of the first and greatest importance. *Kamassi* is not really boxwood, but is alleged to be even superior to it, and the dealers in real boxwood, grown on the East Coast are desirous of prohibiting the use of the term "box" as applied to *Kamassi*. About £1,800 worth of *Kamassi* are sent to Europe annually, some of it in the form of peg-tops.

It is impossible to touch on all the interesting points in the Reports, fires, revenue from game licenses, plantation profits, &c. Cape Town is fortunate in having an area of 8,000 acres situate within 4 miles of the city. There 6 to 8 tons of cluster pine seed are sown yearly and it is expected that if two-thirds of the area is devoted to this purpose, the annual supply of sleepers will reach 1,40,000, thus releasing the Knysna forests from being plundered of good sawyer's timber to be wasted as sleepers. There will be the rest of the area and the waste of the sleepers to supply firewood for Cape Town. The planting of blue gum coppice by land owners is strongly recommended, as it is shown that one acre of blue gum in fair growth can furnish a continuous supply of no less than ten tons dry weight of fuel annually. The cost would be about £ 7 and the profit about £ 15 a year.

The financial aspect of the question hardly concerns us much in India. Mr. Hutchins, however, does not hesitate to declare that it would be easy to make the forests pay off the national

debt of the colony, besides keeping much gold in the colony, and making it at the same time more self-supporting. England pays yearly no less than £14,000,000 for imported timber, *which she could and ought to produce for herself*, but her happy insular position fortunately saves her from climatic consequences. She will not always be able to import to this extent. Other countries are becoming exhausted, and more and more jealous of the remnant. Even if she could always import easily she loses a very honest and hardworking class of population. In Germany there are a million of strong men who live by forests alone, and another 3 millions who live by handling forest produce. In fact 12 per cent. of the population depends on forests. It is thus clear that the utmost urgency attaches to the two questions of increasing the forest area up to 25 per cent if possible, and of placing that area, as far as possible, in safety from the schemes of political or commercial banditti. No country can be well governed so long as its forests and forest policy lie at the mercy of men who care little, and know still less, about the forest need of the country and who may be one year scheming politicians, next year grasping financiers, and the year after bald-headed philanthropic faddists.

F. G.

V-SHIKAR, TRAVEL, & CO.

An Elephant adventure.

Some time ago I wrote a mild protest against the inordinate amount of science and the poverty of shikar in the *Forester*. I have been congratulating myself on the result ever since as I have enjoyed the articles since published on sport immensely; the letter written long ago in a spirit of levity has now, like a badly-thrown boomerang, smitten the person who launched it, as I have since been thinking that I ought to do something to repay the enjoyment given me by "Zoologist" and others—a tender conscience, alas! All my friends know my unconquerable modesty so it will only surprise my enemies that this short yarn does not set forth one of my many deeds of *derring do*, but only recounts one of the mighty deeds of my best friends—a heroine—my bull terrier.

At the end of the cold weather two years ago I had been having a long day at that intensely interesting and most useful work, conducting linear valuation surveys through the teak

forests of my division, for the purpose of estimating the mature crop in a reserve, of which the area being an unknown quantity, anywhere between 80 and 100 square miles, the result was likely to be one that Americans would like to swear to as accurate. I had just shut my book, told the coolies to dry up and had started on what my hunter said would be a short cut to camp. We had not gone far when I saw fresh tracks of a solitary bull bison, and thinking there would be still time before dark with any luck to come up with him, I told the coolies to go straight back to camp while self and hunter, one coolie and my terrier went after the bison; my hunter had his licensed, best action, non-rebounding lock, single, converted Brown Bess, and went ahead tracking. I had a 12 bore Paradox and came second, the coolie followed some 50 yards behind with the terrier in a leash. The track was like all tracks, and need not be described till after about three-fourths of a mile it entered an old ponzo,* very dense with creepers each of which seemed to grow a strong hook with which one could catch a salmon, and the *alagah bin* flourished after its kind. In fact an ideal place for a crusty old bull to lie up in; just as we got to the edge my hunter stopped and pointing to the track of an elephant whispered "To-day." I replied "at present we are after bison and I am not going to tackle elephants with a 12 bore Paradox, in this sweet patch a bison is bad enough, it will give an aged parent an excellent chance of getting something out of the Indian Government, my huge balance in the Forest Officers' Provident Fund to wit, so go on." However, we had only gone about 100 yards, very cautiously, when I was startled by a ponderous sigh, we both stopped at once and peering through the undergrowth we saw the immense hind quarters of an elephant about 6 yards off. The huge beast was nonchalantly pouring dust on his back with his trunk and it was this sound which had attracted our attention. The chance was too good to be missed, I signed to the hunter and we crept back to the coolie with the dog, and told the former what was ahead and that he was to wait with the dog and on no account to let her go. I then crept back to where we had seen the elephant; he was still there, but wishing to find a more vulnerable-looking spot than the root of his tail I started crawling round to the side. I had just got a view of a beautiful gleaming pair of white tusks, when I heard a pattering on the dry leaves behind me; looking round I saw my bull terrier, her eyes blazing with excitement, her hair erect, she could see I was after something and wished to get a bite in. In vain I made a grab at her as she went past, but the rest baffles description, I heard a tempest of barks, terrified and prolonged trumpeting, combined with a noise as if a steam mowing machine was at work in that "ponzo." I thought that directly the terrier found her antagonist was a stone or two above her

* Deserted Taungya or temporary cultivation clearing.

fighting weight, she would run back to me, and I imagined her running between my legs, with the enraged tusker in full cry, winning tusks down, and the picture pleased me not. I looked hurriedly round, the Chins had cut every decent tree down—I have since been absolutely orthodox on the subject of yacutting and the destruction of the forests—the biggest tree was a Yamene (*Gmelina arborea*), it had been badly felled and had 3 very decent stool shoots, about 18 inches in girth each. I went up those 3 sticks quicker than a wooden monkey goes up a string in the strand, and my hunter fled up an adjacent creeper, balancing himself between that and a small tree, looking all the world like a Hulu. Then I had the front seat, or rather stand, at a most exciting scene, the tusker seemed terrified and was prancing round like a top, his trunk curled in a tight knot and trumpeting for all he was worth, the terrier making ferocious rushes at him and springing forward to try and get a grip; the tusker would then charge, as the dog retreated dig ferociously at her with his right tusk, the dog of course being by that time a yard further off; this waltz was coming unpleasantly near my three sticks, so I loosed off into the elephant's head, alas, too high, but it started him off away from me like a runaway locomotive and the terrier shrieking with delight went after him, I breathed a sigh of relief, elephant-baiting is the finest bit of excitement to be got in Asia, but next time I want a heavier gun or safer seat; I was just preparing to shin down my coppice shoots when I heard the din rapidly re-approaching; that infernal dog had headed the beast and was snapping along side, the elephant's tusks being pointed straight for my poles. I let drive right and left, Brown Bess roared to my right and the elephant, thank heaven, swerved away to the left, making off this time not to return. We climbed down and after about 5 minutes the terrier turned up, tongue out, fearfully pleased with herself; she had utterly defeated the king of the forest, routed him trunk and tusks. I went back to the coolie, he explained that he had got frightened, climbed a tree and let the dog go, the elephant we never heard of again. After sorrowfully kicking the coolie we returned to camp.

“TAWKWE.”

VII—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

EAST INDIAN TEAK.—The deliveries for the first seven months of this year are 11,272 loads, compared with 11,679 loads in the same period of 1898, and for July this year 858 loads against 912 loads in July, 1898. The demand in London has been fairly

active, and prices for retail quantities inclined to harden. Prospects ahead are quite assured for the present, and for later on they are not yet very decided. Prices are at a high level, and buyers want to see a continuance of the prosperity of the shipbuilding and kindred trades before committing themselves too heavily. Once that becomes visible a further move in Teak will rapidly follow.

ROSEWOOD—EAST INDIA.—Finds buyers in small lots at steady prices.

SATINWOOD—EAST INDIA.—Is rather dull, and stocks are sufficient.

EBONY—EAST INDIA.—Is seldom asked for.

PRICE CURRENT.

Indian Teak, per load	...	£11 15s.	to £16 15s.
Rosewood „ ton	...	£9	to £11
Satinwood „ foot(superficial) 9d.			to 2s.
Ebony „ ton	...	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST AUGUST, 1899.

TEAK.—The landings in the London Docks last month consisted of 34 loads of logs and 269 loads of planks, against deliveries from the Docks into consumption of 674 loads of logs and 376 loads of planks. The Dock stocks at date analyse as follows:—

5,409	loads of logs, as against	9,767	loads at the same date last year.			
2,779	„ planks „	3,255	„ „ „			
24	„ blocks „	20	„ „ „			
8,212	loads		13,042	loads.		

The demand has been quiet both for landed stocks and floating cargoes, but prices continue to harden, owing to the moderate supplies and the f. o. b. cost of the timber being higher than ever.

MARKET RATES OF PRODUCE.

*Tropical Agriculturist.**August 1st, 1899.*

Cardamoms	per lb.	2s. 6d.	to	2s. 9d.
Croton seeds	„ cwt	40s.	to	55s.
Cutch	„ „	28s.	to	35s.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	65s.	to	75s.
India rubber, Assam	„ lb.	2s. 10½d.	to	3s. 1d.
„ Burma	„ „	2s. 9d.	to	3s. 2d.
Myrabolams, Madras	„ cwt.	5s.	to	6s.
„ Bombay	„ „	4s. 9d.	to	9s. 6d.
„ Jubbulpur	„ „	4s. 3d.	to	6s. 6d.
„ Bengal	„ „	4s. 6d.	to	6s.
Nux Vomica	„ „	7s.	to	10s.
Oil, Lemongrass	„ lb.	2½d.	to	2¾d.
Sandalwood, Logs	„ ton	£20	to	£50.
„ Chips	„	£4	to	£8.
Sapanwood	„	£4	to	£5.
Seedlac	„ cwt.	55s.	to	60s.
Tamarinds, Calcutta	„ „	15s.	to	16s.
„ Madras	„ „	7s. 6d.	to	8s. 6d.

CORRIGENDA.

Indian Forester, July 1899,

- Page 285, line 3 from above, for "*Scaimpesiana*," read "*Schimperiana*."
- „ „ line 22 from below, for "funicled," read "fascicled."
- „ „ line 10, 11 from below, for "Sir George King in his excellent paper" read "Dr. Prain in his excellent paper on Leguminosæin"
- „ 286, line 6 from below, for "calyx, tube" read "calyx tube."
- „ 287, line 8 from above, for "calyx, ube" read "calyx tube."
- „ „ line 3 from below, for "to the variety with smaller leaves" read "to the variety of *A. sericea* with smaller leaves."

THE INDIAN FORESTER.

Vol XXV.]

October, 1899.

[No. 10.

Erythrina Indica.

Two late articles in the *Indian Forester* on the geographical distribution of this tree, induce me to say a few words on the subject. As correctly stated by Kurz and Prain, it is a sea coast tree and its home is the Sundarbans, the coast of Burma, of the Andamans and Nicobars, as well as of the Malay Archipelago and Polynesia. Like other sea coast trees, the *Cocanut*, *Casuarina*, *Thespesia populnea*, it has from time immemorial been cultivated largely in the inland districts of India and Burma, being a fast growing tree easily raised from cuttings, for the support of the Betel vine in the south, and for its showy flowers in the north. In many places it has become naturalized, spread from self-sown seed and hence it is difficult to say whether it actually is indigenous inland. When I wrote the *Forest Flora* in 1873, I was not aware of its being a sea coast tree. I had specimens before me from the districts mentioned but these specimens do not prove that the tree is indigenous inland. It is different with the following definite statements :

1. Kurz, *Forest Flora* I., 369 : dry forests of the Prome district.
2. The anonymous writer in *Indian Forester*, Vol. XXIII. 468 : dry hills of the Prome district in virgin forests, miles away from any village.
3. Mr. Woodrow : in a Bombay swamp.
4. G. M. R., in *Indian Forester*, Vol. XXV. 110 : common in the dry hill forests of the south Thana Forest division, about 50 to 60 miles inland, away from towns and villages, also in the mixed forests of the Tansa lake catchment area.
5. Talbot, *List Bombay* 1894. 71. In the deciduous forests of the Konkan and north Thana.
6. Gamble, *List Darjeeling* district, 1896, 27 : Khair and Sisu forest in the Terai, and banks of rivers in the Lower Hill Forest valleys. Also common in low waste ground near rivers in the Terai.

We will first discuss the Burma localities (1 and 2). Regarding the species Kurz could not have been mistaken. He had thoroughly studied Burmese trees and knew them well. But it does not seem quite certain, whether he gathered the specimens of *E. indica* himself. The anonymous writer in the *Indian Forester* of 1897 may, for all we know, be a great botanist, nay, he may possibly be one of the leading botanists of India. As he has not, however, revealed his name, he must not take it amiss, if we think it possible, that he may have mistaken the species.* As far as I know, there are in Burma four species besides *E. indica*, viz., *E. stricta*, *suberosa*, *ovalifolia* and *lithosperma* all with large scarlet flowers. For *E. holosericea*, Kurz is, as pointed out by Prain, (*Journ. As. Soc. Bengal*, Vol. 66, 11. 72) a mistake, based upon a mixture, leaves of *E. lithosperma* and flowers of *E. ovalifolia*.

It is not likely that *E. lithosperma* (Ye-kathit) should have been mistaken for *E. indica*, for it flowers while in full leaf. In the moist valleys of the Hpyu and Khabaung forests, where it is common, the Betel vine being frequently grown on it, the showy scarlet flowers form a striking contrast to the dark green foliage. *E. indica*, like the other Indian species, is leafless while in flower. *E. ovalifolia* (Kônkathit), according to Kurz, is only found in the tidal forests and in the plains. There thus remain *E. stricta* (Taungkathit) and *E. suberosa*, and one of these may possibly have been mistaken for *E. indica*.

We now come to the Bombay localities, mentioned under 3, 4 and 5. On the west side of the peninsula 2 species only besides *E. indica*, are known, *E. stricta* and *suberosa*. Their characters are so clearly given in Talbot's excellent list, that it is hardly likely a mistake could have been made. The Bombay inland localities in the Thana district, in the Konkan and in North Kanara must therefore for the present be accepted as proof that the tree is indigenous at a distance from the coast in that part of the country. And the same must be said regarding the habitat mentioned by Gamble in the Darjeeling Terai and outer valleys, where he also mentions a second species, probably *E. suberosa*.

For the present, therefore, we may assume that *Erythrina indica* is indigenous in certain inland localities of Pegu, Bengal, and Western India. There are many other trees, shrubs and woody climbers which are commonly regarded as seacoast plants, but which undoubtedly are also indigenous inland. From Professor Schimper's important little work on the seacoast vegetation of India and the Malay Archipelego† I will quote the following species.

* We have looked up the reference. The anonymous writer was a forester and not a botanist; apparently also he based his assertion on Kurz's authority only, so his evidence may be disregarded. HON. ED.

† Die Indo-Malayische Strand Flora. Jena, 1891.

1 *Dodonæa viscosa*.—Linn, common on the coast: Sriharikot, Amherst to Mergui and the Andamans. According to Schimper a seacoast species of the Malay Archipelago. Inland, common in the Punjab, Beluchistan, on the Sandstone hills, (Pachmarhi, Bori) south of the Nerbada river, the Chanda district, the Deccan, Nilgiris and Pulney hills

2 *Cæsalpinia Bonducella*.—Fleming (*O Bonduca*, Roxb; Kurz F. Fl. I., 406), a cosmopolitan sea coast species, at the same time undoubtedly indigenous inland in India and Burma.

3 *Mimusops hexandra*.—Roxb. On the coast at Amherst, Sriharikot, but also indigenous inland on the sandstone hills north of Bori and the Chanda district. Schimper mentions other species of *Mimusops* as littoral. The species of this genus are not easily identified.

4 *Vitex trifolia*—Linn. Sea coast of Ceylon and, according to Schimper, of the Malay Archipelago and elsewhere. Inland, indigenous in Burma and India.

5 *Randia dumetorum*.—Lamk. Coast of Ceylon, Sriharikot, and according to Schimper on the coast of the Malay Archipelago and south China. A common inland shrub of India.

The following I only know as inland species, but Schimper classes them as sea-shore plants of the Archipelago.

Derris scandens, Benth, *Entada scandens*, Benth. and *Woodfordia floribunda*, Salisb. (*W. fruticosa*, Kurz.)

Most species, which have their home on the sea coast, especially of tropical regions, are cosmopolitan, the study of the inland home and the biological characters of their species therefore is interesting and hence I have ventured to draw attention to this subject. As to *Erythrina indica*, more information regarding the inland localities, where it is indigenous, would be interesting, hence I take the liberty, for ready reference, to state the characters by which the different arborescent Indian species of this genus may easily be distinguished

1. Flowers when leafless, calyx spathaceous.

1. *E. indica*.—Lam., Leaflets entire, glabrous. Calyx lin. long, contracted and 5-toothed at the apex. Wings and keel equal, one-fourth the length of standard.

2. *E. stricta*—Roxb. Leaflets entire, nearly glabrous. Calyx $\frac{1}{2}$ in. long, keel half the length of standard, wings much smaller.

11. Flowers when leafless, calyx campanulate or turbinate, limb truncate, or split into several divisions.

3. *E. suberosa*.—Roxb. Branchlets, underside of leaves and inflorescence densely clothed with long soft, bi—or trifurcate hairs. Leaflets entire or sinuate-lobed. Calyx turbinate, 2-lipped, keel half the length of standard, wings minute.

4. *E. ovalifolia*.—Roxb. Leaflets glabrous elliptic, silvery white beneath. Calyx campanulate, splitting irregularly into 2 or more unequal divisions. Corolla dull purple, standard $1\frac{1}{2}$ in. long, keel lin., wings $\frac{3}{4}$ in. long.

5 *E. arborescens*.—Roxb. Leaflets glabrous, from a cordate base broadly ovate, acuminate. Calyx turbinate, limb 2 fid, standard more than twice the length of keel, wings minute. Outer Himalayas, 4000-7000 ft.

III Flowers with the leaves, calyx equally two-lipped.

6 *E. lithosperma*.—Miq. Leaflets glabrous, ovate, acuminate, stipellary glands large, oblong. Lower portion of pod seedless, flat; upper portion shorter, narrower, with 1 to 3 seeds.

D. BRANDIS

The production of Sandal-wood

In the "Forester" for March last, there appeared under the above title a paper to which the Government of India, in connection with the growth of the tree in Coorg has since directed attention. I do not pretend to such a knowledge of the subject as is possessed by other Forest Officers who have served long in Mysore and Coorg. But I have been studying the question for some little time; and if you can afford me the space, I should wish to discuss some points touched upon in the article, both because the writer did not, perhaps, fully realise the general position as regards sandalwood production, and because others may be tempted to continue the discussion of a question of real interest and importance. In my remarks, I shall confine myself for the most part to the sandal-producing belt of the Mysore plateau. The conditions in Coorg influencing the growth of the species are identical with those obtaining in parts of Mysore. I have little knowledge of the sandal resources of the Madras and Bombay Collectorates bordering on Mysore. The quantities, however, of the wood annually sold by the Forest Departments in these Presidencies appear to be small, ranging from 100 to 200 tons in all. Mysore sandalwood greatly preponderates in the East Indian trade. The State is the natural home of the species; and very probably sylvicultural methods or measures of conservancy, successfully applied in Mysore, would be equally successful in the adjoining British districts.

The article of March maintains that there are as yet no fixed opinions as to the best means of assuring a sustained yield; that the proposal to allow the holders of revenue-paying lands to participate in the profits derived from sandal growing on their fields is Utopian and not likely to foster the reproduction of the species; that the attempt to raise sandal in regular plantations should not be abandoned; and that the tree should be introduced by seed-dibbling throughout reserves suitable for its reception.

To the last proposition no objection seems possible, provided artificial (as opposed to natural) sowings are required at all. For, so far as my experience goes, wherever, in the comparatively narrow sandal-bearing belt of country, a forest is

really suited to the growth of the species and can be protected from cattle and fire, there will the tree be present, plentifully-seeding and reproducing itself naturally. Nature, aided by the severe penalties for sandal destruction enforced during the last 100 years and more, appears long ago to have introduced the species into all the areas best suited to the tree. No doubt there are tens of thousands of acres, coffee estates and arable lands, where the species once thrived but no longer exists and where it could easily be propagated. But I venture to think that, given a strictly conserved forest, *apparently* well suited to sandal, yet in which sandal has never grown in natural conditions, efforts to grow fine trees are most unlikely to succeed. One of the most marked characteristics of the species is the contrast between the robustness of its habit and the readiness with which it reproduces itself under natural conditions and its sensitiveness to human intervention of any kind. Thus, self-sown seedlings may be observed growing like weeds in garden pots containing flowering and foliage plants. Yet experience shows that had seed, from the same parent trees, been simultaneously and carefully sown by hand, the results would not have been so good. There are exceptions, of course. Nobody has asserted that sandal cannot be grown from hand sowings or plantings. The species has been introduced with admirable results *so far* into the casuarina plantations. But ultimate success cannot be predicted with any confidence. The conditions of growth in the plantations are, as I propose to show, both abnormal and temporary. Everything is in the experimental and transition stage. Mature sandal from hand sowings does not, it is believed, exist in India; and we know that sandal, on the Mysore tableland, is never found growing naturally under the conditions in which, with less or greater success, we have been attempting to make it grow in the regular plantations.

In discussing the future of sandal, the writer of the article aforesaid deals with the three following sources of supply:—

(a) Trees near cultivation, in hedgerows, on grazing grounds or private lands:

(b) Trees in reserves grown either naturally or by cultural operations aiding natural reproduction; and

(c) Trees in regular plantations. To these I would add;

(d) Trees in the extensive district (*i. e.*, nominally protected) forests and in all waste lands, the property of Government.

Now, the writer of the March article, while admitting (a) to have been an important source of supply in the past would not rely on it for the future. But his premises were, in some degree, mistaken, and it seems to me that his conclusions can be reasonably objected to. Why should not this source of supply be as important in the future as in the past? Unquestionably I think because, at the close of the nineteenth century, the Government sandal monopoly, as at present enforced over private

lands, is an anachronism and the people will not tolerate it much longer. A century or so ago, when there were no village schools, and when Tippoo is stated to have punished sandal damage with the loss of a limb (including sometimes the head) the position may have been intelligible and defensible enough. But at the present day the ryot has no longer the same reverence for the sandal tree. If he allows a seedling to persist and grow up he incurs the liability of protecting it and of answering for all damage done to the tree. If he successfully protects the tree, what does the Government give him in return? Nothing. Under the present rules, the ryot is permitted to remove by the plough, in *bonâ fide* cultivation, seedlings less than three feet in height. But he is naturally careful to remove as well seedlings growing in his hedges and enclosures and there is at present no practicable means of hindering him from doing so. He now fully realises the onerous and one-sided nature of the monopoly; and the consequence is that unless there be a change of practice, sandal in private holdings will soon become rare and eventually extinct. The article treats of a proposal to induce the ryot to raise or protect sandal trees by promises of payment 50 or 60 years hence, and assumes, if I properly understand, that areas under class (a) are, or will be "roamed over by cattle and goats, where the plants run the constant risk of being eaten or being burnt by jungle fires and of being hacked down by the villagers." No wonder, then, that the project of growing sandal under (a) was treated as chimerical! There is, however, no question of inducing a ryot to do something by offering to pay money to his posterity. He would, like most people, greatly prefer cash down, and that is what was proposed; namely, to grant, in Coorg, a ready-money and sufficiently liberal payment based on the estimated value of each tree uprooted. If a 10% payment be made (thus reducing the nett profit to Government from 90% to 80%) the ryot would have every inducement to grow and to protect sandal. A few good trees would pay for his land assessment several times over. He clearly would not "hack down" anything so valuable to him. Fires do not overrun private lands and neither, generally speaking, do cattle and goats. It is in fact almost as easy for the ryot to raise and to protect, as it is for him to destroy, sandal in his holding. Those who have local experience, foresters, district officials, planters and others, appear to be of this opinion and to agree in thinking that, in default of a ryot's share, there will soon remain few trees on private lands. Trustworthy evidence on the point would be easily procurable in the Civil and Military Station of Bangalore, where the monopoly is in full force. When advocating the grant of a share to Coorg ryots, I was unaware that the late Conservator of Forests in Mysore had moved in the same direction and that, in 1875 under British rule, orders had actually been issued to allow the ryots to participate in the profits. The rules, however, were not put in force, and the Chief

Commissioner asked the Government of India to cancel them on the grounds, amongst others, that they "*would be productive only of embarrassment and difficulties, and that they would afford considerable facilities for fraud against Government, whose monopoly of the sandalwood is adequate to secure its interests, so far as regards the preservation in localities where its growth is free and unimpeded.*" (The italics are mine). But the Government of India demurred, thought the rules were a move in the right direction, and in their letter (No 875, dated 7th September 1867) which has been published, went on to say like a true prophet:—

"You say that the Government monopoly of sandalwood is adequate to secure the preservation of that existing in occupied lands, and that the proposed rules would add considerably to the present heavy duties of Amildars of taluks and village officers, while in your opinion it is extremely doubtful whether they would work efficiently in practice. But it appears to His Excellency in Council that the fact of there being a Government monopoly cannot alone be expected to suffice for the protection of the seedlings and young trees. It is understood that the sandalwood grows best on fields and in hedgerows, and it is obviously the interest of the ryot rather to destroy than to preserve the trees growing on or near his fields. It seems unlikely that the fear of penalties would prevent the occupant of the land from destroying seedlings and young trees, when he could do so with very little chance of being detected, and it appears to be more than probable, that as the ryots become year by year more alive to their own interest, the number of trees in the hedgerows will decrease. The notification issued by Sir Richard Meade tends to give the ryots a pecuniary interest in the protection of the young sandalwood trees in their fields, and it seems to the Governor General in Council that their preservation is more likely to be secured by the hope of reward than by the fear of penalties."

Nevertheless, the rules were subsequently cancelled. The objections taken, to them locally, appear to have been founded more on administrative difficulties anticipated in their application, than on the principle involved. In any case, circumstances have greatly changed for the worse in the course of the last 25 years, and nobody with local knowledge can any longer suppose that the monopoly is sufficient to safeguard the preservation of the species. Whether the rules of 1875 will be re-introduced in a modified form is doubtful. There are very extensive areas of Government sandal-producing forests which, under an improved system of protection and working, may possibly suffice to meet all requirements. But I am confident, to paraphrase your article of March last, that the justification for the concession to the ryot would be the "certain expectation" that reproduction would

improve and that the future supply of wood thereby be increased. The only question at issue, it seems to me, is whether the ryots would not grow more sandalwood than could ultimately be absorbed by the market. I would leave this side of the question with the remark that *in present circumstances*, the only areas, with few exceptions, where sandal will grow well naturally, and where at the same time it can be adequately protected, are private lands.

Next as to (b) sandal trees in reserves, grown naturally or by cultural operations, there can presumably be no doubt as to the good policy of fostering the growth of the species in reserved forests where protection can be assured and where soil and climate are suitable. But where are such reserves to be found? When about 1860, forest conservancy first received attention, and subsequently, the policy was to take up and reserve forest tracts as free as possible from rights of user, and containing timbers valuable for construction, such as teak and rosewood. These forests never did nor could contain sandal, which it was thought might be left to take care of itself in virtue of the monopoly. Until recent years little effort appears to have been made to constitute reserves in the submontane and plains country comprised in the sandal-bearing belt. But the advisers of the Government of India seem, for a number of years, to have entertained doubts as to the future of sandal and from time to time they uttered warning notes as, for instance, in 1880 when it was suggested that "open jungles" where the natural tree exists should be reserved in Coorg. But the Indian Forest Department severed its connection with Mysore about that time and the question of future supply has since not been so fully considered. During many years no forest, either in Mysore or Coorg, appears to have been reserved mainly in connection with sandal growth. At the present day, in the sandal belt, cultivation has been extended, all kinds of forest rights or users have arisen; and in both provinces the constitution of sandal reserves is no longer the comparatively simple matter that at one time it apparently might have been. There are several examples, however, on the Mysore plateau which conclusively prove what might be done for sandal by taking up "open jungles," where the tree grows naturally, by limiting conservancy to fire-protection and the regulation of cattle grazing. A notable object lesson is afforded by the Devayadurga State forest in the Tumkur district, mentioned at page 66 of Sir D. Brandis' Report on Forest Administration in the Madras Presidency. This area has, with the exception of a small fire in 1882, been continuously fire-protected since 1868, and the pasturage of cattle has been consistently regulated. In considerable portions of the forest sandal grows luxuriantly, with tall stems carrying the girth well up. The tree reproduces itself freely and, owing to the protection afforded and to the presence of suitable cover, dibblings of seed have given remarkably good

results. The principal species associated with the sandal are Albizzias, Acacias, Cassias, *Ziziphus* (*xylopyra* and *Oenoplia*), *Erythroxylon monogynum*, *Canthium parviflorum*, *Premna tomentosa*, *Wrightia tinctoria* and *Dendrocalamus strictus*. The question even arises whether the conservancy, so far as a sandal is concerned, has not been too good, as the general tree-growth appears in places to be too dense. But this defect can, without difficulty, be remedied by thinning out relatively valueless stems where the sandal has attained sufficient height of bole and is, therefore, no longer in need of special protection, except, of course, from fire. The main point is that in this forest, and in other areas naturally suited to sandal and similarly circumstanced (unhappily there are very few), the tree grows freely and healthily, simply because sufficient protection is assured to it.

Turning to (c), Trees in Regular Plantations, your article suggests that, before the plantations are condemned, it should be ascertained whether comparative failure is due to cultural mistakes in planting, &c, or to the absolute inadaptability of the tree to regular plantations. In this connection the following propositions will perhaps be accepted as correct. (1) For many years, planting in "regular plantations" has been tried with great care under a variety of conditions and by different Officers of experience, some of whom have devoted years to the work in Mysore and Coorg. (2) The "regular plantations" have been costly. (3) They have as a whole so far given no definite results from which a probability of ultimate success, if the operations are persisted in, can be foretold. (4) Many of them have utterly failed or are at present in an unpromising condition. (5) Nowhere in India can self-sown sandal be found growing naturally in conditions approximating to those obtaining in the "regular plantations". (6) It has not been shown that regular plantations are economically necessary in view of the sandal trade generally.

The continuance of regular plantations will not presumably be advocated simply in order to prove eventually and at a great cost whether sandal can or cannot be healthily grown in such circumstances. The justification for plantations must be, it is thought, a well-founded presumption that the operations are really necessary if the sandal supply is to be maintained and that they will ultimately be profitable. But has that test been applied to them, can their continuance be deemed necessary and indeed is planting under any circumstances required at all? I think not; or at least that planting ought not to be necessary if proper means were taken to provide for the natural growth of the tree. I write of the sandal-bearing belt in Mysore, not of Coorg. In Coorg the sandal area is relatively of very small extent and the conditions influencing reproduction are more unfavourable than in Mysore generally. Probably in Coorg artificial reproduction by dibblings in suitable areas suitably protected (if any such can be found) will be expedient; the more so as Coorg is a separate

competitor in the matter of sandalwood sales. But, taking the sandal country as a whole, the continuance of regular plantations, even if promising well, would I think be open to question. Plantations other than those classed as "regular," into which sandal has been introduced at a nominal cost, are much more promising and, on the score of expense also, cannot be regarded in quite the same light. The cheap introduction of the species into the casuarina plantations has so far been successful to a degree which appears phenomenal judging from the results secured at so much greater a cost in Coorg. The casuarina trees seem to be ideal nurses to the young sandal plants which were dibbled in at their bases and which in many areas are healthy and growing rapidly. In some cases the sandal growth is so rapid as to overtake that of the casuarina planted previously. Thus I recently measured a sandal tree 12 years old, girthing 18 inches and not less than 35 feet high. The casuarina trees immediately adjoining, planted in 1887, were slightly smaller. Nothing could look more promising. But, as has been pointed out in the article of March, the problem will be to maintain conditions suited to sandal as soon as the time comes, as it very soon will come, to remove *all* the casuarina trees. The casuarina is not suited to the Mysore plateau where the tree grows slowly and dies when young (at from 15 to 25 years of age). The purpose for which the plantations were formed no longer exists, and from a monetary point of view replanting is inadvisable. One difficulty is that while the casuarina fails to reproduce itself naturally the introduction under its shade or in conjunction with it of indigenous trees or shrubs is no easy matter. Endeavours to secure the desired mixture are now being made, and on their result the persistence in good health of the sandal will probably depend. The curious point is that the sandal, which is all young and quite immature, is growing really well under conditions never naturally found on the Mysore tableland. We should probably, however, not be justified at present in drawing, as the writer of the article in the March number would do, conclusions from the casuarina-cum-sandal combination, and in applying those conclusions for the introduction of the sandal tree into all suitable reserved areas.

Lastly, comes (*d.*) sandal in district forests and other Government waste lands. The areas included in this category are very extensive. They comprise by far the greater part of the sandal belt, excluding village common lands and cultivated holdings. Their extent, so far as sandal is concerned, is not known. Much of their total area is not under the management of the forest department, and a further portion, although nominally subject to certain rules of conservancy, is really not protected in any way. All the sandal-bearing lands in this class are subjected to firing and cattle-grazing without any restriction. There is no doubt that sandal is disappearing from firing and other causes more or less preventible, the annual

loss of valuable wood is very great. Probably the total annual loss is not less than 2½ lakhs of rupees of what may be called sandal revenue-producing capital value. Measures are contemplated, which it may be hoped, will not merely lessen the annual loss but will much increase the growing stock of sandal trees. The bearing of the management of these lands on sandal production in future is very important. Already, in some parts of the country, the fixed annual sale of wood is not collected so easily as once was the case; and this is the more significant when it is remembered that only dying or dead stems are supposed to be uprooted. How many have died from natural decay and how many have been killed by fire or other injury is unknown. The main supply of wood has hitherto always been drawn from these areas (class *d*) or from private lands (class *a*). The condition and prospects of both classes as regards future supply appear to be about equally unfavourable. But while, as has been shown, an effective remedy could be applied to class (*a*), the efficient protection of class (*d*.) will certainly be much more difficult and, in the cases of some forests, may be impossible.

What is the average annual average outturn of Indian sandal-wood. Taking Mysore first, the average annual quantity of heart-wood sold during the 10 years ending with 1894-95 was 2,200 tons, yielding Rs 7,87,000. The previous and subsequent sales were, however, somewhat less. In 1898-99 the quantity was 2,061 tons yielding Rs. 7,86,000. Arrangements are annually made for the sale of 2,000 tons; and this figure may be taken as the annual demand on the Mysore forests. In Coorg, during the decade ending 1897-98, the average yearly sale was 118 tons yielding Rs. 47,600. An enquiry instituted in 1896 showed that, from 1890-91 to 1894-95 inclusive, the average yearly transactions from all sources amounted to 2,372 tons, the excess above the Mysore-Coorg output being attributed to sales of wood in districts of Madras and Bombay and to small imports from abroad. The total annual demand may perhaps be taken at 2,800 tons, of which 2,000 tons are furnished by Mysore. About one-half of the wood is exported to China, Egypt, European ports and to the United States. Whether the foreign demand, so far as wood for oil distillation is concerned, will be maintained, is an open question. Oil distillation has been started in Western Australia, where an abundant supply of the wood (*S. Cygnorum*) is stated to be obtainable, and large quantities of Macassar and Venezuela oils have been latterly distilled. Competition to secure a cheap product is keen, and small quantities of West Indian oil have, for that reason, recently been even imported into this country. Analyses, however, have proved the incontestable superiority of the East Indian product, and it may therefore be hoped that foreign competition will not permanently affect our export trade.

The question arises : can an annual supply of some 2,800 tons of wood be assured ? I believe it can be assured by ordinary measures of protection and without resort to costly plantations. It is simply impossible to adduce at present statistics of value in support of this opinion.* The exact area of forest and other land capable of yielding good sandalwood is not known but is certainly great, relatively to the demand for wood. The tree census, which has been in progress for some years, is not reliable. Even admitting the returns to be accurate, the prevalence of forest fires and other damage is such that the figures are useless, or almost so, in estimating what the condition of the stock will be 20 or 15 years hence. It seems probable that much, if not most of the annual demand of 2,300 tons might be regularly furnished from assessed lands alone if the occupiers be given a personal interest in the costly wood. It is also certain that by the suppression of fires throughout the sandal-producing district forests and Government grazing *kavals* the natural supply of the wood would be largely increased. There are lastly the reserved forests which, though relatively of small extent, are important. Taking the resources of the sandal-bearing belt as a whole, it is difficult to conceive of them as unable to furnish so small a quantity as 2,300 tons of wood annually if measures are taken to protect and increase the natural spread of the species. But if such measures are not taken, it would I think, bearing in mind what is going on, be unreasonable to expect that the present outturn can be very long maintained.

To maintain and, if desirable, to increase, that outturn a radical change of practice appears necessary. It is no longer possible to suppose that the monopoly safeguards the existence of the trees or that sandal forests may be fired or subjected to unrestricted cattle grazing with impunity. The case lies in a nutshell. Sandal will grow freely if protected from cattle and especially from fire: if not so protected it cannot thrive and must in the long run become extinct. The change of practice, it seems to me, should comprise (a) the grant to the ryot of a share in the value of all sandal uprooted from his land for sale by Government; (b) the constitution of reserved forests out of such portions of the district forests and grazing lands as are not burdened with many private rights or privileges, and the application to

* Since the above was written, a map, prepared in connection with the Paris Exhibition, indicates that the total area of the principal sandal-bearing tracts in Mysore is about 5,450 square miles. The largest belt, running from the north-west to the south-east of the province, is about 240 miles in length with a mean width of about 16 miles. The approximate area over which sandal trees have so far been enumerated is now returned at 2,722 square miles. The number of trees enumerated between January 1896 (when the work was begun) and March 1899 is as follows.—

Dead trees ..	78,459	Mature trees ...	5,94,521
Decaying trees ..	1,39,390	Young trees ...	18,65,864

The system of enumeration is faulty in various ways, and the figures are not to be relied upon.

the reserves of strict rules for the prevention of fire and the regulation of grazing; and (c) the prevention of fire by every possible means in the remaining sandal-bearing district forests and waste lands. To carry out (a) seems to be a relatively simple matter; and it is not easy to understand in what direction the measure would endanger the monopoly enjoyed by the Mysore Government. Machinery to efficiently carry out (b) and (c) does not at present exist but will, it is hoped, be provided ere long. I have personally no doubt that were such a change of practice as has been outlined introduced and vigorously persisted in we should hear no more of the sandal supply being endangered.

I refrain from entering in detail into questions connected with the cultivation of sandal. The young plants certainly will not as has been pointed out, stand "drip." The tree in all stages of growth except the youngest (say up to 10 years of age) seems to thrive best in nature when its crown is as free as possible and when good lateral protection is given to the stem. In default of lateral shade the young or half-grown tree often assumes a bush like growth, especially in poor and mediocre soils, and this greatly decreases its value. Possibly the idea that sandal likes the soil at the roots covered is due to the fact that a tree surrounded, as is often the case, by a low-growing thorny bush is protected from cattle and indirectly, from fire. It has been noticed in some localities that the cattle eat up the grass immediately adjoining the bush, where the fodder is presumably of slightly better quality, and thus create a kind of fire trace. The hardiest and the best oil-producing sandal trees may be observed, with an admixture of other trees and shrubs, in poor, gravelly, well-drained often ferruginous soils: the finest, so far as outward appearance goes, in hedgerows (allowing a free head and lateral shade) or in well-protected forests, such as that of Devarayadurga already mentioned. But totally different conditions are found in the casuarina plantations in which sandal is doing so well and which therefore are to some people, a kind of silvicultural puzzle.

J. L. PIGOT.

The Ballad of the Railway Sleepers.

How do the sleepers
 Go down to the plains ?
 I went to discover this
 Once on a time :
 And blessed with some leisure,
 I'll tell you in rhyme.
 Up on the mountains
 So blue and so far
 They are felling the cedars
 And stout deodar.
 For yearly in Delhi
 The Managing Staff

Demand good sleepers,
A lakh and a half,
For their metre gauge railway
Which via Ajmere,
Bears back the exile
Toward England dear.
The sawyers have shaped them
With axe and saw
Six feet of length
Without knot or flaw.
And the coolies have borne them
A mile or so
Down the steep home
Of the buck and doe.
Another mile
Round the mountain side
On a man-pushed tramway
The sleepers ride.
Hence to the plain
How shall they go ?
For its still six thousand
Feet below.
Here down the steep
Is a sledge-car road
Fifteen sleepers
Make a load.
Give them a push
And away they fly
A hundred feet
In the twink of an eye.
Or if you prefer it
On wire of steel
They can cross a valley
With even keel,
For twenty seconds
Flying there
Through twice seven hundred
Feet of air
Now they meet
An aqueduct
Neatly against
The mountain tucked;
Breadth ten inches,
Joining strong,
Downwards ever
It leads along.
So let water
Do its part,
Throw them in
And give them a start.
Sometimes swift.
And sometimes slow
With the water.
Along they go.

Here at length,
They reach the shoot.
A thousand feet
From top to foot.
See the water
Leap and gush
Startled out
By their downward rush ;
Once again
On a gentler grade
On they speed
Through the forest shade
Now they're nearing
The valley bed
Stream of the Kulni
Watershed
Over the stage
Like boys at school
In they plunge
To a limped pool
Now beware
Of an awkward block,
Full six miles,
Of shallow and rock.
Line the sides
With built-up sleepers
And make the channel
Narrow, but deeper.
Then when the rest
Of the army's gone
Pull down the sentries
And pass them on
Yet twice the moon
Must wax and wane
E're the stream assumes
Its wont again
And the last of the fifteen
Myriad hoard.
Launches forth
On the river broad.
So from Kulni to Tons
And Gons to Jumna
Salls the mountain's
Late alumna:
Past the Siwaliks
And through the plains,
Till the Delhi ramparts
At length it gains,
Now take it over
You Railway lot ;
Let the sleeper sleep
In its ballast cot.

Lay it to rest,
 (It has travelled far)
 In the permanent way
 Of the R. M. R.

E. F. E. W.

II.—CORRESPONDENCE.

Mechanical Tests of Ceylon Timber.

I forward, a copy of the May 1899 number of the Imperial Institute Journal which contains an article on certain Ceylon Timbers which you may think worth reproducing in your paper.

As the names of trees given in the paper are often incorrect, I write them again—together with Botanical names—both for your information.

They are :—

1. Sapu	<i>Michelia Champaca.</i>
2. Panakka	<i>Pleurostylia Wightii.</i>
3. Gurukina	<i>Calophyllum Burmanni.</i>
4. Vinnanku	<i>Pterospermum suberifolium.</i>
5. Satinwood	<i>Chloroxylon Swietenia</i>
6. Milla	<i>Vitex altissima.</i>
7. Illanthai	<i>Zizyphus Jujuba.</i>
8. Mondora	<i>Vatica Roxburghiana.</i>
9. Ubberiya	<i>Carallia calycina.</i>
10. Tawenna	<i>Palaquium petiolare.</i>
11. Dawata	<i>Carallia integerrima.</i>
12. Margosa (or Nim)	<i>Azadirachta indica.</i>
13. Lunnumidella	<i>Melia dubia.</i>
14. Walukina	<i>Calophyllum bracteatum.</i>
15. Ranai	<i>Alseodaphne semecarpifolia.</i>
16. Chomuntiri	<i>Heritiera littoralis.</i>
17. Suriya	<i>Thespesia populnea.</i>
18. Jak	<i>Artocarpus integrifolia.</i>
19. Del	<i>Artocarpus nobilis.</i>
20. Halmilla	<i>Berrya Ammonilla.</i>
21. Suriya Mara	<i>Albizzia odoratissima.</i>
22. Nedun	<i>Pericopsis Mooniana.</i>

Note. Nos: 1, 2, 3, 6, 8, 9, 10, 11, 13, 14, 17, 19, 20, 21 and 22 are Sinhalese names; Nos: 4, 7 & 15 are Tamil and 5, 12 and 18 English names.

Colombo.

22nd September, 1899.

A. R. BROWN
 Conservator of Forests.

EXTRACT FROM THE IMPERIAL INSTITUTE JOURNAL.

REPORT ON THE RESULTS OF MECHANICAL TESTS APPLIED TO A
SERIES OF LOGS OF TIMBER RECEIVED FROM THE CEYLON

GOVERNMENT.

(By Professor W. C. UNWIN, F. R. S., *Referee to the Scientific and Technical Department of the Imperial Institute.*

The whole of the samples (22 in number) were in a dry and well seasoned condition, but some of them had serious drying cracks or shakes. No. 8 sample (Mandora), and No. 20 (Halmilla) have a good elastic range. No. 13 is an exceptionally light timber and—as would be expected—of relatively low strength. On the other hand, No. 22 (Hedun) is a very heavy timber of relatively great strength. No. 16 (Chomunti) is rather heavier than No. 22, but its strength is not so great.

No. 14 (Walukina) is a rather light timber of good strength.

The following tabular statements give :—

- (1) The heaviness of the timbers ;
- (2) Their resistance to shearing along the fibres ;
- (3) The crushing strength ;
- (4) The transverse strength ;
- (5) The deflections observed in the bending tests ; and
- (6) The co-efficient of elasticity from the bending tests.

TABLE I.—HEAVINESS.

No. of Specimen.	Name of Timber.	Locality.	Weight of Timber in pounds per cubic foot.
1 (c)	Sapu	Ceylon	41.75 } mean
	"	"	41.70 } 41.42
2 (c)	Panah Ka	"	55.06 } 54.68
	"	"	54.66 }
3 (c)	Gurukina	"	63.02 } 62.62
	"	"	62.23 }
4 (c)	Vulnauku	"	40.58 } 40.41
	"	"	40.34 }
5 (c)	Satinwood	"	64.66 } 64.32
	"	"	63.98 }
6 (c)	Milla	"	60.81 } 60.92
	"	"	61.03 }
7	Hauthai	"	48.87
8	Mandora	"	59.70
9	Ubbriya	"	56.71
10	Jawenna	"	46.11
11	Dawata	"	47.33
12	Margosa	"	47.32
13	Luonmidella	"	20.30
14	Walukina	"	32.41
15	Ranai	"	63.31
16	Chomunti	"	75.46
17	Suriya	"	50.23
18	Jak	"	43.37
19	Del	"	48.00
20	Halmilla	"	49.93
21	Suriya Mara	"	57.01
22	Hedun	"	70.79

TABLE II.—RESISTANCE TO SHEARING ALONG THE FIBRES.

No. of Specimen.	Name.	Locality.	Area sheared. Sq. in.	SHEARING STRESS.	
				Pounds per sq. in.	Tons per sq. in.
1 (f)	Sapu ...	Ceylon.	4·010	753	0·3359
2 (f)	Panah Ka ..	"	3·960	745	0·3325
3 (f)	Gurukina ...	"	3·999	948	0·4231
4 (f)	Vuinauku ...	"	3·960	486	0·2170
5 (g)	Satinwood ...	"	3·999	1,903	0·8496
6 (g)	Milla ...	"	4·100	1,147	0·5116
6 (f)	" ...	"	4·240	880	0·3936
6 (h)	" ...	"	4·000	984	0·4392
7	Hauthai (1) ...	"	4·120	1,013·4	0·452
8	Mandora (2) ...	"	3·994	620·4	0·277
9	Ubbriya (1) ...	"	4·041	1,066·6	0·476
10	Jawenna (3) ...	"	4·036	1,083·7	0·484
11	Dawata (5) ...	"	3·880	1,075	0·480
12	Margosa (4) ...	"	3·835	1,326·0	0·592
13	Lucumidella (6) ...	"	3·901	478	0·213
14	Walukina (1) ...	"	4·096	336·9	0·150
15	Ranai (5) ...	"	3·821	925	0·413
16	Chomunti (5) ...	"	3·940	1,333	0·595
17	Suriya (1) ...	"	3·862	926·9	0·414
18	Jak (5) ...	"	3·881	672	0·300
19	Del (7) ...	"	3·744	1,236	0·551
20	Halmilla ..	"	4·028	830·3	0·371
21	Suriya Mara (7) ...	"	3·880	1,283	0·572
22	Hedun (5) ...	"	3·920	1,486	0·663

- (1) Nearly plane fracture. (5) Fairly plane fracture
 (2) Rather ragged fracture. (6) Broke partly by tension.
 (3) Irregular fracture, small knot. (7) Very irregular fracture.
 (4) Irregular fracture.

TABLE III.—CRUSHING STRENGTH.

No. of Specimen.	Name.	Locality.	DIMENSIONS IN INCHES.		Area of crushed section. Sq. ins.	Crushing stress. Tons per sq. in.
			Section.	Height.		
1 (c)	Sapu ...	Ceylon.	3·049 × 3·057	8·130	9·320	1·570 (5)
2 (c)	Panah Ka ...	"	3·157 × 3·159	8·075	10·020	2·768
3 (c)	Gurukina ...	"	3·061 × 3·034	8·085	9·285	2·408 (5)
4 (c)	Vuinauku ...	"	2·892 × 2·874	7·984	8·312	1·932
4 (d)	" ...	"	2·891 × 2·892	8·057	8·360	1·942
4 (e)	" ...	"	2·917 × 2·876	7·967	8·389	1·927
5 (c)	Satinwood ...	"	3·151 × 3·166	8·008	9·974	3·374
6 (c)	Milla ...	"	2·890 × 2·925	8·007	8·453	3·118
7	Hauthai (2) ...	"	3·100 × 2·672	8·146	8·283	2·778
8	Mandora (1) ...	"	3·194 × 3·068	8·139	9·799	2·619
9	Ubbriya (1) ...	"	3·033 × 3·026	8·140	9·178	3·433
10	Jawenna (3) ...	"	3·043 × 3·034	8·152	9·232	3·454
11	Dawata (1) ...	"	2·879 × 2·862	8·034	8·240	2·670
12	Margosa (1) ...	"	3·086 × 2·497	8·171	7·706	2·987
13	Lucumidella (1) ...	"	2·872 × 2·850	8·037	8·166	1·858
14	Walukina (4) ...	"	2·910 × 2·819	8·026	8·203	2·743
15	Ranai (2) ...	"	2·563 × 2·888	8·015	8·268	2·605
16	Chomunti (1) ...	"	2·913 × 2·867	7·974	8·351	2·938

TABLE III.—CRUSHING STRENGTH (*Concluded.*)

No. of Specimen.	Name.	Locality.	DIMENSION IN INCHES.		Area of crushed section. Sq. in.	Crushing stress Tons per sq. in.
			Section.	Height.		
17	Suriya (4) ...	Ceylon.	2 976 × 2 833	8 036	8 430	2 818
18	Jak (2)	"	2 887 × 2 873	7 910	8 323	3 400
19	Del (1)	"	2 896 × 2 869	7 925	8 308	2 832
20	Halmilla	"	3 012 × 2 996	8 146	9 024	3 442
21	Suriya Mara (1)	"	2 881 × 2 851	8 012	8 214	4 184
22	Hedun (1)	"	2 884 × 2 851	7 933	8 222	3 919

- (1) Gave way by shearing (4) Split along the grain.
 (2) Gave way by shearing and splitting (5) Knot in specimen.
 (3) Split before testing. Gave way by shearing

TABLE IV.—TRANSVERSE STRENGTH.

No. of Specimen.	Name.	Locality.	DIMENSION IN INCHES			Centre Break- ing Load Pounds.	Coefficient of Trans- verse Strength	
			Breadth	Depth	Span In.		Pounds per sq. in.	Tons per sq. in.
1 (a)	Sapu	Ceylon.	2 925	3 378	42	4,000	7,551	3 370
1 (b)	"	"	2 924	3 387	42	4,320	8,078	3 606
"	"	"	"	"	"	Means	7,315	3 448
2 (a)	Panah Ka	"	2 815	3 378	45	5,860	12,690	5 661
2 (b)	"	"	2 919	3 363	48	6,140	13,230	5 907*
"	"	"	"	"	"	Means	12,960	5 784
3 (a)	Gurukina	"	2 909	3 378	45	4,980	10 800	4 820
3 (b)	"	"	2 920	3 355	45	3,100	6,673	2 979
"	"	"	"	"	"	Means	8,737	3 900
4 (a)	Vuinanku	"	2 014	3 387	45	4,455	9,596	4 284
4 (b)	"	"	2 853	3 369	48	4,240	9,432	4 210
"	"	"	"	"	"	Means	9,514	4 247
5 (a)	Satinwood	"	2 914	3 381	48	5,540	12,630	5 635
5 (b)	"	"	2 916	3 375	48	6,800	14,930	6 685
"	"	"	"	"	"	Means	13,700	6 150
6 (a)	Milla	"	2 912	3 376	48	6,780	14,710	6 504
6 (b)	"	"	2 919	3 353	48	6,790	14,810	6 612
"	"	"	"	"	"	Means	14,760	6 588
7	Hauthai	"	2 873	3 271	40	4 000	7,793	3 479
8	Mandora	"	2 859	3 287	40	7,060	13,710	6 125
9	Ubbriya	"	2 886	3 290	40	5,285	10,090	4 505
10	Jawenna	"	2 868	3 252	40	4,154	8,068	3 602
11	Dawatta (1)	"	2 875	3 275	40	5,560	10,815	4 83
12	Margosa	"	2 865	3 286	40	5,921	11,480	5 125
13	Lucumidella (1)	"	2 842	3 266	40	2,890	5,720	2 55
14	Walukina	"	2 814	3 259	40	4,490	9,014	4 024
15	Ranai (1)	"	2 868	3 273	40	5,410	10,565	4 71
16	Chomunti (1)	"	2 861	3 231	40	7,210	14,485	6 46
17	Suriya	"	2 859	3 262	40	5,913	11,660	5 206
18	Jak (2)	"	2 872	3 270	40	3,500	6,839	3 053
19	Del (1)	"	2 871	3 284	40	4,806	9,307	4 155
20	Halmilla (1)	"	2 844	3 090	40	6 995	15,450	6 898
21	Suriya Mara	"	2 869	3 238	40	7,322	14,600	6 518
22	Hedun (1)	"	2 850	3 059	40	7,130	16,040	7 161

- * Broke by shearing and tension. (1) Broke by tearing on tension side.
 (2) Split diagonally along the grain.

MECHANICAL TESTS OF TIMBER.

TABLE V - DEFLECTIONS OBSERVED IN THE BENDING TESTS

No.	Deflection.	Centre Load, Pounds.														
		0	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500	7,000
1 (a)	Increment of Total	0	Ins 0 078	Ins 0 078	Ins. 0 074	Ins 0 072	Ins 0 064	Ins. 0 084	Ins. 0 028	Ins	Ins	Ins	Ins.	Ins	Ins.	Ins.
1 (b)	Increment of Total	0	0 096 0 096	0 078 0 174	0 084 0 208	0 122 0 330	0 010 0 340	0 082 0 422	0 096 0 508	0 176 0 654						
2 (a)	Increment of Total	0	0 092 0 092	0 086 0 175	0 074 0 252	0 080 0 332	0 182 0 414	0 265 0 482	0 056 0 568	0 100 0 668	0 200 0 958					
2 (b)	Increment of Total	0	0 119 0 119	0 089 0 208	0 060 0 268	0 132 0 400	0 071 0 470	0 074 0 544	0 056 0 600	0 124 0 724	0 140 0 864	0 276 1 141	0 265 1 405	0 332 1 740		
3 (a)	Increment of Total	0	0 110 0 100	0 080 0 80	0 068 0 248	0 092 0 340	0 160 0 400	0 100 0 500	0 116 0 616	0 132 0 748						
3 (b)	Increment of Total	0	0 111 0 111	0 080 0 191	0 080 0 271	0 076 0 347	0 112 0 459									
4 (a)	Increment of Total	0	0 140 0 140	0 106 0 248	0 085 0 346	0 145 0 484	0 142 0 636	0 200 0 836	0 186 1 024	0 734 1 758						
4 (b)	Increment of Total	0	0 140 0 140	0 132 0 272	0 116 0 388	0 130 0 518	0 136 0 656	0 184 0 820	0 680 1 500							
5 (a)	Increment of Total	0	0 100 0 100	0 070 0 170	0 056 0 256	0 084 0 340	0 074 0 414	0 094 0 508	0 100 0 600	0 052 0 690	0 136 0 820	0 146 0 974	0 214 1 180			
5 (b)	Increment of Total	0	0 086 0 086	0 074 0 160	0 040 0 200	0 140 0 304	0 086 0 370	0 060 0 431	0 072 0 502	0 072 0 74	0 078 0 680	0 100 0 750	0 114 0 864	0 080 0 944	0 180 1 124	
6 (a)	Increment of Total	0	0 086 0 096	0 082 0 185	0 078 0 266	0 080 0 346	0 076 0 422	0 082 0 504	0 040 0 546	0 142 0 686	0 082 0 748	0 152 0 900	0 092 0 992	0 150 1 142		
6 (b)	Increment of Total	0	0 084 0 084	0 092 0 186	0 082 0 248	0 080 0 328	0 081 0 408	0 081 0 468	0 071 0 538	0 068 0 600	0 094 0 700	0 102 0 802	0 104 0 906	0 200 1 106	0 234 1 340	
7	Increment of Total	0	0 100 0 100	0 160 0 160	0 092 0 252	0 168 0 320	0 112 0 432	0 065 0 503	0 120 0 620							
8	Increment of Total	0	0 058 0 058	0 027 0 085	0 013 0 115	0 012 0 150	0 026 0 176	0 055 0 232	0 026 0 255	0 057 0 295	0 052 0 347	0 033 0 400	0 048 0 448	0 057 0 505	0 099 0 604	0 376 0 950
9	Increment of Total	0	0 055 0 055	0 048 0 088	0 042 0 140	0 042 0 182	0 055 0 237	0 040 0 286	0 060 0 346	0 048 0 395	0 073 0 468	0 079 0 550				
10	Increment of Total	0	0 052 0 052	0 048 0 100	0 036 0 136	0 039 0 175	0 055 0 230	0 035 0 268	0 070 0 438	0 064 0 412						
11	Increment of Total	0	0 072 0 072	0 016 0 120	0 060 0 200	0 035 0 235	0 073 0 305	0 082 0 390	0 150 0 440	0 132 0 572	0 121 0 693	0 207 0 900	0 505 1 400			
12	Increment of Total	0	0 072 0 072	0 060 0 132	0 063 0 195	0 065 0 260	0 070 0 330	0 063 0 393	0 091 0 484	0 084 0 568	0 112 0 650	0 090 0 770	0 262 1 032			
13	Increment of Total	0	0 110 0 110	0 090 0 200	0 120 0 328	0 153 0 481	0 293 0 774									
14	Increment of Total	0	0 044 0 044	0 057 0 100	0 045 0 145	0 053 0 195	0 052 0 250	0 071 0 310	0 080 0 371	0 075 0 443						
15	Increment of Total	0	0 086 0 086	0 074 0 160	0 085 0 245	0 082 0 330	0 088 0 368	0 072 0 480	0 082 0 542	0 108 0 650	0 150 0 800	0 155 0 955				
16	Increment of Total	0	0 050 0 050	0 050 0 100	0 052 0 172	0 020 0 160	0 053 0 233	0 054 0 267	0 055 0 281	0 080 0 361	0 071 0 452	0 080 0 502	0 150 0 630	0 150 0 760	0 270 0 940	
17	Increment of Total	0	0 096 0 096	0 152 0 148	0 082 0 230	0 082 0 312	0 085 0 377	0 073 0 450	0 115 0 685	0 071 0 636	0 122 0 755	0 192 0 950	0 234 1 164			
18	Increment of Total	0	0 105 0 105	0 080 0 165	0 068 0 253	0 079 0 332	0 086 0 398	0 082 0 480	0 080 0 580							
19	Increment of Total	0	0 075 0 075	0 050 0 125	0 032 0 157	0 067 0 224	0 040 0 264	0 061 0 325	0 040 0 365	0 063 0 425	0 072 0 600					
20	Increment of Total	0	0 067 0 067	0 033 0 100	0 065 0 185	0 045 0 210	0 055 0 265	0 053 0 316	0 051 0 371	0 049 0 420	0 060 0 545	0 085 0 625	0 080 0 820	0 195 0 820	0 210 1 030	
21	Increment of Total	0	0 045 0 045	0 045 0 090	0 060 0 150	0 040 0 190	0 055 0 240	0 035 0 260	0 042 0 322	0 055 0 380	0 035 0 415	0 061 0 476	0 044 0 520	0 070 0 570	0 058 0 648	0 105 0 765
22	Increment of Total	0	0 042 0 042	0 040 0 091	0 038 0 129	0 039 0 168	0 048 0 216	0 041 0 257	0 053 0 310	0 046 0 356	0 040 0 396	0 054 0 450	0 072 0 522	0 058 0 580	0 090 0 670	0 205 0 875

TABLE VI.—CO-EFFICIENT OF ELASTICITY FROM BENDING TESTS.

No.	Name.	Locality.	Range of stress. Pounds per square in.	Elastic deflection per 100 pounds load in inches.	Co-efficient of Elasticity.	
					Pounds per square in.	Tons per square in.
1 (a)	Sapu ..	Ceylon	0 to 7,551	0·0146	1,126,000	502·3
1 (b)	" ...	"	0 to 8,078	0·0145	1,125,000	502·0
2 (a)	Panah Ka	"	0 to 12,690	0·0162	1,519,000	678·1
2 (b)	" ...	"	0 to 13,230	0·0171	1,431,000	638·6
3 (a)	Gurukina...	"	0 to 10,800	0·0160	1,542,000	688·2
3 (b)	" ..	"	0 to 6,673	0·0174	1,403,000	625·9
4 (a)	Vulsaaku	"	0 to 9,596	0·0254	961,800	429·2
4 (b)	" ..	"	0 to 9,432	0·0262	967,200	431·7
5 (a)	Satinwood	"	0 to 12,630	0·0173	1,419,000	633·6
5 (b)	" ..	"	0 to 14,930	0·0144	1,712,000	764·3
6 (a)	Milla ..	"	0 to 14,710	0·0155	1,592,000	710·8
6 (b)	" ...	"	0 to 14,810	0·0152	1,639,000	731·4
7	Hauthai ...	"	0 to 3,000	0·0166	955,800	426·7
8	Mandora ...	"	0 to 6,000	0·0084	1,872,000	835·4
9	Ubbriya ...	"	0 to 4,900	0·0099	1,596,000	712·5
10	Jawenna ...	"	0 to 3,000	0·0089	1,783,000	798·0
11	Dawata ...	"	0 to 3,500	0·0126	1,257,000	561·3
12	Margosa ...	"	0 to 4,000	0·0142	1,109,000	495·0
13	Lucumidella	"	0 to 1,500	0·0218	739,000	330·1
14	Walukina ...	"	0 to 2,500	0·0100	1,646,000	734·7
15	Kanai ...	"	0 to 3,500	0·0155	1,028,000	459·0
16	Chomunti...	"	0 to 5,000	0·0100	1,651,000	737·2
17	Suriya ...	"	0 to 4,000	0·0159	1,014,000	452·6
18	Jak ..	"	0 to 3,000	0·0160	995,600	444·4
19	Del ...	"	0 to 4,500	0·0111	1,418,000	632·8
20	Halmilla ...	"	0 to 5,000	0·0109	1,749,000	780·7
21	Suriya Mara	"	0 to 5,500	0·0095	1,736,000	775·0
22	Hedun ...	"	0 to 5,000	0·0090	2,180,000	972·9

III.—OFFICIAL PAPERS & INTELLIGENCE.

Proportion of bark to wood in Kikar, Sal & Assaina.

The following is the result of certain experiments undertaken in the Lahore, Dehra Dun, Kumaun, Garhwal and Ganges Forest Divisions, at the instance of the Inspector-General of Forests, to ascertain the proportion of dry bark to wood in Kikar, Sâl and Assaina trees.

416 PROPORTION OF BARK TO WOOD IN KIKAR, SÂL AND ASSAINA

The Deputy Conservator of Forests, Lahore Division, reports that from experiments made with 5 *kikar* trees, varying in girth from 5 to 6 feet, and of about 25 to 30 years in age, the proportion of bark and twigs to the timber and fuel is as 1 to 4 : i.e., in 100 parts by weight of the whole tree, there are 80 parts of timber and fuel by weight and 20 parts of bark and twigs by weight.

In the above experiments the trees were felled in November 1898 and the weighings were made in March 1899.

The Assistant Conservator of Forests, Dehra Dun Division, gives the details of five well-grown *sâl* trees experimented with in the Dholkot forest as follows :—

	Girth with bark at 4 ft.	Girth, without bark.	Height.	WEIGHT OF				
				LEAVES, GREEN.	TWIGS AND BARK.		WOOD.	
					Green.	Dry.	Green.	Dry.
			Feet.	Seers.	Seers.	Seers.	Seers.	Seers.
A ...	15"	...	35	..	35	14	32	25
B ..	24½"	..	45	15	99½	39½	131½	102
C ...	35"	28½"	71	37½	292	135	595	461
D ..	50"	44"	71	88½	632	322	1,390	1,077
E ..	63"	...	76	100½	772	381	2,357½	1,826

The dry weights have been reckoned out on the assumption that the proportional weights per cubic foot of fresh and seasoned *sâl* are 71 and 55 lbs.

The latter figure is obtained from Gamble's "Manual of Indian Timbers," and the former was obtained from the measurements and weights of one 10" *kari* which were taken on the spot carefully.

It may be noted that D had a bigger crown than the others, having been grown in more open forest. The only general rule that can be deduced is that the proportion of bark to wood, which is high at first, grows less as the trees grow older.

The Conservator of Forests, Central Circle, North-Western Provinces and Oudh, has supplied the figures for *sain* trees given below with the remark that in the Garhwal Division the bark was not quite dry when the experiments were carried out, and it would appear that all the smaller twigs were included

in and weighed as bark. This probably largely accounts for the difference between the results arrived at by Garhwal and those of the other two Divisions.

Statement showing results of experiments undertaken in the Kumaun, Garhwal and Ganges Divisions with the view of ascertaining the proportion of dry bark to wood in Assaina trees.

Division.	Serial number of trees	Girth class.	Weight of wood fit for timber and fuel.	Weight of dry bark.	Proportion of dry bark to wood by weight.
			Seers.	Seers.	Per cent.
Kumaun ...	1	I	4,680	705	15.0
	2	I	4,275	890	20.8
	3	I	3,227	528	16.4
	4	II	2,403	370	15.4
	5	II	2,493	333	13.4
	6	II	2,886	480	16.6
	Average		3,329	551	16.5

Division.	Serial number of trees.	Girth Class.	Weight of timber (dry).	Weight of bark (dry)	Proportion of dry bark to timber by weight.	Weight of wood fit for fuel (dry.)	Weight of bark (dry).	Proportion of dry bark to firewood by weight.
		Girth.	Seers.	Seers.	Per cent.	Seers.	Seers.	Per cent.
Ganges ...	1	1-8' 8"	2,083	339	16.3	3,703	697	18.8
	2	1-7' 11"	2,113	223	10.6	3,484	407	11.7
	3	1-6' 9"	1,017	181	17.8	2,235	266	11.9
	4	11-5' 6"	833	111	13.4	1,207	167	13.8
	5	11-5' 7"	912	166	18.2	973	183	18.8
	6	11-4' 7"	466	69	14.8	871	167	19.1
	Average		1,237	181	14.6	2,077	314	15.1

Statement showing results of experiments undertaken in the Kumaun, Garhwal and Ganges Divisions with the view of ascertaining the proportion of dry bark to wood in Assaina trees—continued.

Division.	Serial number of trees.	Girth.	Weight of wood <i>green.</i>	Weight of bark in cluding unbark- able branches <i>green.</i>	Proportion of bark to wood by weight <i>green.</i>
			Seers.	Seers.	Per cent.
Garhwal	1	8' 0"	6,495	1,355	20.9
	2	3' 4"	958	434	45.3
	3	3' 6"	998	375	37.6
	4	4' 0"	1,097	395	36.0
	5	6' 0"	3,246	619	19.1
	6	6' 4"	2,868	620	26.2
	Average.		2,527	633	25.0

Imperial Institute Quarterly Report.

Quarterly Report by Professor W. R. Dunstan, F. R. S., Director of the Scientific Department, on enquiries conducted for the Government of India.

A number of investigations of Indian natural products are being conducted in the Scientific Department, and since the date of my Annual Report of April last several enquiries have been completed.

In connection with the examination of the tanning materials of India two Reports have been submitted on this subject. The first deals with the value of Indian Mangrove barks and of extracts prepared from them. In conducting this enquiry, chemical analyses have been made in order to ascertain the amount of tannin contained in the various mangrove barks and extracts, and in addition, with the assistance of tanning and dyeing experts, trials have been conducted of their value as tanning and dyeing agents.

Thirteen samples of Mangrove barks and extracts have been systematically investigated in this way, and the results show that some of these materials are extremely rich in tannin, and would be valuable as tanning agents, were it possible in the case of the

extracts to avoid the production of so much colour. I have therefore suggested that certain experiments should be conducted in India with a view to the preparation of extracts of Mangrove barks by such special processes as are likely to avoid the formation of the colour which is so detrimental from the tanner's point of view.

The second report on the Tanning materials of India relates to the "*Caesalpinias*," especially to *Caesalpinia coriaria* (Indian divi-divi), and *Caesalpinia digyna*. The results of systematic investigation of these two varieties show that Indian divi-divi, or, at any rate, the particular samples now under discussion, are inferior in tanning value to the product derived from South America which is now largely employed in this country. Before, however, final conclusions are drawn as to the inferiority of Indian divi-divi, it would be well to examine other samples than the two at present received, both of which came from the Province of Bengal. In *Caesalpinia digyna*, which has so far been used only locally in India as a tanning agent, we probably have a material of considerable commercial value, for it appears from the investigations now made that the "pod-cases" of this plant contain a very large amount, nearly 60 per cent. of tanning matter, so that it is possible that the value of this material may be even greater than that of South American divi-divi. The results of trials of the tanning value of the ground pod-cases by an expert confirm the result of the chemical analysis and indicate that this material compares very favourably with the best divi-divi of commerce, and indeed may possibly show some considerable advantage as compared with it. I have, therefore, suggested that a much larger supply of this substance should be sent to England, with a view to a trial being made on a large scale in a tan yard.

A series of 31 samples of coals and coke have been analysed at the request of the India Office for Major Mahon, R. A., of Cossipur, in order to assist him in his enquiry as to the possibility of smelting certain iron ores of Madras; and with the same object and also at the request of the India Office, analyses have been made of 23 samples of limestone which had been collected under the supervision of Major Mahon.

The results of the various investigations of Indian coal and Indian iron ores which have been now conducted in and through this Department seem to furnish grounds for the opinion that the smelting in India of certain native ores may prove to be a feasible undertaking.

With reference to the enquiries now proceeding, but not yet completed, I need only say that there are under investigation several Indian medicinal plants, India-rubber, tanning-material, fibres, and other natural products which have been forwarded by the Reporter on Economic Products.

(Sd) Wyndham R. Dunstan,

13th July, 1899.

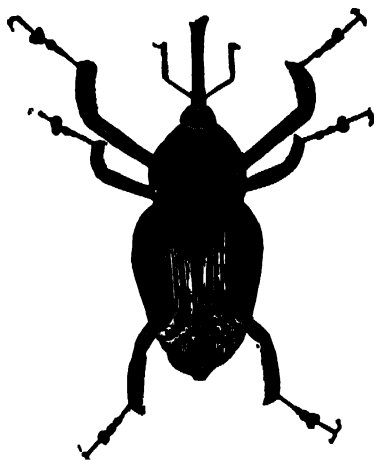
Director, Scientific Dept.

An Injurious Beetle in the Chittagong Division.

I have noticed that in the Sitapahar Teak plantation in the Chittagong Division a weevil, the full life-history of which I have been able to put together, which attacks the young shoots of Paiya or Muli Bamboo (*Melocanna bambusoides*), I sent a specimen to the Indian Museum for identification. The weevil turned out to be *Cyrtotrachelus longipes*, and I was informed that this species had not yet been reported as injurious.

C. longipes is a large, brown-coloured insect, with a dark patch on the thorax and dark patches on the sides of the elytra. The elbow of the antennæ is formed by one long joint coming out a little above the insertion of the proboscis, and by eight small joints, the last being flattened out and enlarged. The accompanying sketch of the insect is natural-size.

The differences between the male and the female should be noticed. The female, as a rule, is larger, the front legs being highly developed. There is also a difference in the two probosces, that of the female being generally more pointed at the apex with the addition of a few sharp protruberances along its two sides on the upper surface, which are generally wanting or only slightly developed in the male.



Imago. Nat. size.

Cyrtotrachelus longipes.

Illustrations are given showing these differences.

Male front leg, (nat. size.)



Female front leg, (nat. size.)

The insects were first found by me on the 26th of June. Four were captured, two being larger than the rest. I got a wooden box, with the top and bottom knocked out, and placed it over some earth in which had been stuck 3 or 4 young bamboo shoots; I covered the top of the box with a bit of perforated zinc, so that the movements of the beetles, which were imprisoned inside, could be seen. After flying about and knocking themselves against the sides of the box, they settled down quietly.

One of the large ones settled on a bamboo shoot. After some time it was found that an oval incision had been made, about $\frac{3}{4}$ in. long and $\frac{1}{2}$ in. deep. On examination I found, at the bottom of the incision, two chips of the soft substance of the bamboo, the size of the eggs I give a drawing of, which were in contact with each other. At first I thought that the beetle was eating. The beetles were taken out in the evening and the young shoot examined. To my surprise I found that the two bamboo chips, of the same whitish colour as the substance of the shoot, were exactly covering two other seemingly similar chips, which on closer inspection turned out to be the eggs which the beetle had laid.

Eggs
(nat size.)

The perfect insects, after emerging, pair soon and the time occupied in pairing and laying their eggs extends to about a month. The beetles may be seen throughout the months of June, July, and the first half of August. The damage to the young shoots was noticed about the beginning of July when the attacked shoots began to die off. The dying shoots were found to contain the larvæ, which are large legless grubs, with slight fleshy tubercles on the under side of the body, corresponding to the number of segments, which are 13, including the head portion. Each shoot was occupied by only one larva, hence it is probable that only one of the two eggs (if they do lay only two) comes to maturity and eventually gives birth to the larva. The shoots attacked were always under about 3 feet in height and consequently thick, fleshy and soft. On cutting some of the attacked shoots it was found that the larva always bored downwards, eating away the soft central portion and increasing in size at a rapid rate.



Larva nearly full-grown,
Natural size.

Longitudinal
section.

Young larva
attacking a
bamboo
shoot Nat.
size.



They make their way downwards (*vide* sketch showing position of grub) till they are fully fed, by which time they probably reach the tougher lower portion of the shoot, they then retreat backwards to their starting point (which is generally about 3 inches below the top), and cut the shoot right off, so that the top portion (3 inches) falls off with the larvæ inside it.

The larvæ were found in all stages of growth on my next visit (15th July). Hence it appears that the larval stage lasts about a month or even less ; and, as it is shown that it takes about a month for the beetles to finish pairing and laying their eggs, we naturally expect that in one month all the larvæ would be fully fed. This gives about 2 months, during which the insect may be found in the larval or injurious stage, *i. e.*, through July, August, and perhaps on to the beginning of September. The young bamboos spring up with the beginning of the rains and by the end of August the ruin is most apparent. Everywhere young shoots are seen dead with their tops off.

Young bamboo shoot showing the portion which eventually forms the abode of the pupa.
(Nat. size.)

earth, turned out on examination to be the dwelling place of the pupa. It seems that the larva, after being fully fed and letting itself fall with the top portion of the young shoot round it, digs a hole into the soft moist earth and enters it, carrying with it the top of the young shoot, which completely protects it, and there it undergoes its transformation. The top soon decomposes, and only the harder fibres persist. Inside this fibrous covering the pupa remains during the following cold and hot seasons and then emerges as an imago a short time after the first burst of the rains in June, when the ground becomes moist. This moisture seems to be necessary for the effectual casting off of the skins of the pupæ. The pupæ are in close connection with the decayed shoot, which forms a kind of mould, covering every

The dwelling of the pupa.

portion of the pupa. The pupal stage lasts about 7 months, during which time the pupæ with their homes get hardened by the excessive heat, especially towards the commencement of the rains. Then, when it finds that its joints are beginning to get damp, it probably makes its first efforts to escape. The depth below the surface of the ground at which the pupæ are found is about 3 to 4 inches, or even more, depending on the stiffness of the soil. The larva, when full-grown, has a strong pair of mandibles which come in very useful for this digging.

The number of shoots which die annually, owing the attack of these insects, is very large, and it is noticeable that shady places under thick growth are preferred to others. The Kaptai plantation consists of teak, under which there are no bamboos, or only a few; whereas the forests just outside the parts planted up consist mainly of bamboos, and it is here that the ravages of this insect are centred. As we penetrate further into the forests, their attacks seem to diminish, till at last they cease. They seem to have restricted themselves chiefly to those portions in the vicinity of which there is teak, but the cause of this is not apparent.

The larger legs in the female beetle may be explained by the fact that, the bamboo shoots which she has to grasp when boring to lay her eggs, are generally about three inches in circumference. The front legs of the male would scarcely suffice to grasp so large an object.

Again, the larger size of the proboscis in the female, as compared with that of the male is, no doubt, to enable her to do the extra amount of boring when preparing the egg cavity, and the protuberances which are found on her proboscis may possibly assist in the process of boring into hard tissue.

Kaptai, 18th August, 1899.

J. P. GREGSON.

VI.-EXTRACTS NOTES AND QUERIES.

Colonial Timbers for British Carriage Builders.

A deputation from the Institute of British Carriage Manufacturers visited the Imperial Institute some time ago, for the purpose of inspecting the various timbers in the Colonial and Indian Collections and ascertaining their suitability for use in carriage-building. It was pointed out that, in the manufacture

of carriages for different climates, the selection of suitable timber had become a question of great importance to the trade, as it was found that the woods which were well suited to a temperate climate were quite unsuitable for use in the tropics, and *vice versa*. The deputation closely examined many of the samples of wood displayed and were very favourably impressed with the extensive collection, of the existence of which, prior to their visit, the greater number of its members were quite unaware. There is no doubt that individual members of the carriage-building trade would find it advantageous to visit the Imperial Institute and examine for themselves the specimens of timbers exhibited in its galleries.

One of the chief wants of carriage-builders at the present time is wheel timber of fine quality, grown and very carefully seasoned in a tropical climate, to enable wheels to be made that will wear well on carriages sent to tropical countries. The following woods are mostly used in this country for the parts of wheels:—for the stocks, elm; for the spokes, oak; for the felloes, ash. For stocks the wood must be dense and tough, and capable of holding the wedges of the iron axle boxes without splitting. The spokes must be hard, tough and elastic. The felloes must be hard and tough, and the grain of the wood should follow the curve of the wheel. Planks for the foot-boards, bottoms and panels of carriages must be free from knots, and season without cracks absolutely, must resist the influence of damp and of water, must be fairly dense, tough, and be easily bent when steamed. They should also not exude any sap or other substance which would prevent paint adhering or injure the paint or varnish subsequently.

The Colonial woods that found most favour with the deputation, as best suited for use in carriage-building, were:—New South Wales: White beech, red ironbark, spotted gum, grey ironbark. Victoria: Blue gum (for spokes), blackwood, box (for stocks) ironbark (for spokes). Queensland: Red cedar (for panels). India: Teak, sissoo (*Dalbergia sissoo*), Canada: Black ash, slippery elm, common elm, red and black oak, black and white birch, shell-bark hickory, black walnut.

Another important requirement of carriage-builders is a suitable timber to supplement the failing supply of English ash, its characteristics of strength without excessive weight, freedom from internal strain in seasoning, and its toughness and elasticity, being a combination of qualities very difficult to find in any other wood. With the view of bringing this matter to notice in our colonies, letters were written to the proper authorities in Canada, the West Indies and Australia, forwarding a small sample of English ash, with a description of the qualities most important in carriage-building, and requesting that if any similar timber could be found likely to become a suitable substitute, samples should be sent to the Imperial Institute for practical trials, together with information as to price, dimensions, and extent of possible supply.

The samples which were forwarded in accordance with this request were duly submitted to tests, by the Institute of British Carriage Manufacturers, copies of the reports being furnished to the senders of the samples. With regard to the samples received from Canada :—European ash is not indigenous to Canada, and is only planted as an ornamental tree. The white ash of Canada is most nearly similar to English ash, but the tree was believed to be too scarce for any extensive export to be made. It was thought probable, however, that small lots could be collected from the numerous local mills and thus, if a regular market could be established, a considerable quantity might be rendered available for export. A favourable report was received from the Institute of British Carriage Manufacturers on the logs of white ash, to the effect that the wood was considered “a very good supplementary to English ash, and a favourable opinion was formed as to its working qualities.” In the province of Nova Scotia white ash is more abundant, but the trees are very small in size. The sample logs, although the wood possessed some of the toughness and elasticity of English ash, yielded planks of too small an average width (eight inches) for any extensive application in carriage-building. If rather wider timber could be supplied, it would be very useful for bent work, as Victoria heads, van rails, etc., and for door pillars and such work. A small sample sent from Jamaica was also reported on favourably, although the sample was too small for a definite opinion to be expressed. Large sample planks of this wood, Santa Maria wood (*Calophyllum calaba*) have since been received, but after further trials it was not thought suitable or the best class of work.

Imperial Institute Journal.

Ceylon Forest Department.

THE CONSERVATOR'S REPORT FOR 1898.

AFTER a careful reading of Mr. Broun's report for the past year we are struck with the moderate tone of his really telling criticisms upon the Government interference with the Department that took place during his absence from the Island last year. Opportunity was then taken to obtain a report upon the state of the Department, Mr. F. C. Fisher, C.S., Acting Conservator, being chosen to draw it up. The conclusions of this report were, it will be remembered, at variance with the Conservator's opinions, and Mr. Broun found it necessary to reply. As a consequence of his report—the necessity of which has not been proved—Mr. Fisher was requested to submit proposals for the re-organisation of the Department. And what was the substance of these proposals? It was very much that of similar proposals made in the opening

chapter of Mr. Broun's report for 1896. On the latter's return to the Colony, he was graciously included by Government in the Committee appointed to report on Mr. Fisher's proposals. But—and here must have lain a source of the utmost annoyance to the Conservator who has been so continuously badgered—partial effect had already been given to these proposals before Mr. Broun returned. Yet we find the mere fact alone chronicled—nothing more. Perhaps silence is stronger than words, and the Government will be warned in time not to try the patience of their trained officers beyond the limits of natural endurance.

The following changes, which were described less specially in the Commissioner's report (extracts from which appeared in our issue of February 23rd), are those that have come into effect with the present year—changes which Mr. Broun has accepted and therefore, no doubt, intends to make the best of :—

(i.) Separation of the *General* from the *Provincial* Forest Administration, the former including the management of areas to be reserved as permanent forest estates under the direct control of the Conservator, while the latter dealt with forests and waste lands available for the extension of cultivation. In the Western and Sabaragamuwa Provinces and in the Galle and Matara Districts of the Southern Province, however, this separation was not recommended for the present for any forests whether reserved or not, but it may take place when the rights of the Crown, in and over waste lands, have been determined after survey. The inclusion of certain valuable forest blocks, which have for the present been left under the charge of Government Agents, has been left for discussion later.

(ii.) Division of the forests under General Administration into the following six charges or "circles" each under an Assistant Conservator, viz :—

(a) *Northern Circle*, including the valuable forests in the Northern Province and serving the export centres of Jaffna, Mannar, and Mullaitivu.

(b) *North-Eastern Circle*, comprising the forests of the Trincomalee District, West Tamankaduwa, and the eastern portion of the North-Central Province, and serving the export centre of Trincomalee.

(c) *Eastern Circle*, consisting of the valuable forests of the Batticaloa District (excluding the Panawa pattu), Tamankaduwa east, and the Nilgalla pattu, Province of Uva, and serving the export centres of Kalkuda bay, Batticaloa, and Arugam bay.

(d) *South-Eastern Circle*, composed of forests of the Panawa pattu, Eastern Province, the Hambantota District, and the southern portion of Uva, and serving the ports of Okanda and Hambantota.

(e) *North-Western Circle*: valuable forests of the North-Western Province and a few in the western portion of the North-

Central Province, serving the port of Puttalam and the market centres of Kurunegala and Chilaw.

(f) *Hill Reserves*: hill forests of the Nuwara Eliya District and Haputale and in Matale north, Central Province, serving the planting districts and the town of Kandy.

(iii.) Working of the forests under the Conservator of Forests on a more systematic and concentrated plan, and of those not required for reservation by a system of licenses.

(iv.) Reduction of the number of officers and of expenditure on staff, while providing an improvement of the prospects of the superior and clerical staffs.

The effect of these changes will be, in Mr. Broun's opinion to injure the finances of the Department for a while, because of the large area now made available for obtaining timber for sale, and the low rates at which this timber will now be sold. On the other hand, the Department will benefit by the P.W.D. being henceforth allowed to supply itself in the open market, the Forest Conservancy being thus enabled to relinquish the practice of keeping deteriorating stock on hand to wait the good pleasure of the P. W. D. With regard to the area of the circles above specified, these are the figures supplied, with the Conservator's comments thereon:—

	Square Miles.
Northern Circle	1,587.50
North-Eastern Circle	1,858.00
Eastern Circle	2,200.00
South-Eastern Circle	2,297.00
North-Western Circle	1,556.75
Hill Reserves	518.00

Total ... 10,012.25

It is, however, not to be understood that all this area is forest, much less *good* forest. Considerable areas will have to be excised and placed again under the control of Government Agents, and they will possibly amount to from one-half to two-thirds of the total area. On the other hand, there are certain valuable forests which have not been included within the circles which it will be desirable to place under the control of the Conservator.

A good deal of demarcation has gone on during the past year, the Central, Uva and Subaragamuwa Provinces alone being untouched.

The enumeration of the bits of surveying done reads somewhat jaggedly, and after vainly endeavouring to grasp a solid estimate and a fairly lucid idea of the work accomplished, we come on the following paragraph as upon an oasis, and we most heartily re-echo the cry for method, *method*, METHOD, which is there very soberly expressed:—

"It is necessary that all the areas placed under the Conservator be now worked on a systematic plan. The enumeration

surveys and measurements of sample plots which have been hitherto made are unfortunately not sufficient for fixing a possibility, either by volume or by area, for our principal species. It is, however, imperative that the past disconnected way of carrying on operations here, there and everywhere, should be changed, and I have assumed for the present that most of our important species take about forty years to grow from the second girth class ($\frac{1}{2}$ ft. 6. in girth) to first class (6 ft. girth). For the present, therefore, and until we can get more reliable data from sample plots, about one-fortieth of the area will be worked each year, taking only such first class trees as can be spared for exploitation. Before long I hope that a reconsideration of this system can be made. It is intended that cleanings and seed fellings should precede the principal fellings by a few years. The fuel reserves will be worked on a rotation of twenty years."

On the subject of sample plots further interesting information is supplied. The measurement of these is, we are glad to learn, becoming more universal in the different Provinces; but unfortunately several that were started have been left neglected. On them the different species of trees have not been sufficiently represented and deductions as to rate of growth have been rendered unreliable. Valuable material is expected in a few years; but, meanwhile, as Mr. Broun says, "ten years have passed, during which most important data might have been got together."

The reorganisation of the superior staff has now come to pass, and effected a reduction in the number of officers—a course which is to a certain extent satisfactory to Mr. Broun, since, as he points out, it is one which he has advocated as far back as 1891. Even with the 34 rangers, which form the executive staff—at salaries ranging from Rs. 1,500 to Rs. 360—under the new scheme, the staff, including 17 rangers, under the Conservator, it is shown, is still somewhat small considering that some 10,000 square miles have to be administered; and this fact will scarcely be affected if more than half the total area is given back to the Provincial Administration. The Conservator very wisely remarks, however, that it is better at the outset not to overman the Department, but to add to it as fresh requirements are proved.

The review of the plantations for Artificial Reproduction shows every promise, and a rebuke is duly administered for the previous disparaging remarks on them, made by Mr. Fisher, apparently without personal inspection of the plantations. This portion of the Conservator's report we shall reproduce in full. The indiscriminate issue of free grants in the little populated districts of the North-Central Province and Trincomalee is also deservedly condemned, as tending to foster untidiness and a want of self-reliance. Nor is it, we may add, likely that the native estimation of the value of land in the neighbourhood of the

Northern Railway likely to be increased by these doles from the Government landlord.

With regard to the financial results the surplus has fallen short of what was anticipated, partly because of the value of plumbago lands leased (the rents Rs. 20,105 not being put down as forest revenue), and partly because the value of timber on lands in the N.-W. Province (Rs. 20,000) was not credited to the Department in actual cash. The net surplus (Rs. 14,738) would, with these additions, have attained Rs. 54,843, or more than double that of last year. In 1896 it was Rs. 9,607 but in 1897 we are at a loss for the correct figures; for in Mr. Fisher's Report for 1897, it is put down at Rs. 23,573, and in the comparative table in Mr. Broun's statement for 1897 and 1898 it is given as Rs. 27,872. This is entirely due, we notice, to the surplus for the Eastern Province being given in the former table as Rs. 15,368, and in the latter as Rs. 19,167; similarly the total Eastern Province and receipts differ in both cases. In conclusion we have the following paragraph accounting for the delay, upon which we were about to comment, in issuing the report:—

"There is again delay in the submission of this report on account of the lateness in receiving the provincial reports. This is due to the precipitate hurry with which officers were transferred to new headquarters just before my return from home, the consequence being that the records are in one place with the Government Agents, and the Assistant Conservator and his clerical staff in another. The result is delay in obtaining necessary data and in submission of reports."

In view of this we do not see how any blame can attach to the Conservator himself, and further we have to thank him for a peculiarly interesting and succinct account of the Department under his charge—one which stands in the first rank of public importance to the people and colonists of Ceylon.

Tropical Agriculturist.

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

September 4th, 1899.

EAST INDIAN TEAK—The deliveries to date for 1899, are 12,894 loads against 12,637 for the same months last year. In the month just closed they have been 1,922 loads against 928 loads in August, 1898. The London Dock stock has been rather freely replenished in the last fortnight, probably, however, only

with a view to distribution from a convenient centre. Prospects for next year's shipments are still a little difficult to foresee, but the trade demand continues good and prices at just about the highest rates for July.

ROSEWOOD.—EAST INDIA.—Continues to sell without hesitation at full prices.—

SATINWOOD.—EAST INDIA.—The demand shows no improvement, and stocks are rather heavy.—

EBONY.—EAST INDIA.—Does not meet with much enquiry.

PRICE CURRENT.

Indian Teak, per load	...	£11 10s.	to £16 10s.
Rosewood „ ton	...	£9	to £11
Satinwood „ foot(superficial)	5d.		to 9d.
Ebony „ ton	...	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

1ST SEPTEMBER, 1899.

TEAK.—The landings in the London Docks last month consisted of 1,575 loads of logs and 298 loads of planks, against deliveries from the Docks into consumption of 1,024 loads of logs and 519 loads of planks. The Dock stocks at date analyse as follows:—

5,960 loads of logs, as against	9,313 loads at the same date last year.
2,558 „ planks „	3,527 „ „ „
8 „ blocks „	20 „ „ „
<hr/> 8,526 loads	<hr/> 12,860 loads.
	„ „

Notwithstanding the above welcome imports, the stock of logs is still abnormally low, but two further cargoes are in course of discharge, and these will serve to help merchants to cope more efficiently with the steady demand for Teak from all quarters. Prices on this side continue very firm, whilst contracts for forward supplies from India are almost impossible to arrange, owing to the prohibitive prices required at the shipping ports.

Business during August may have suffered by the general holiday making, but consumption remained good, and prices all round hardened, rather than otherwise, owing to the prevailing confidence in the continuance of good trade.

THE INDIAN FORESTER.

Vol. XXV.] November, 1899.

[11.

On the determination of the Fungi which attack Forest trees in India.

The study of the fungi which are found in the forests of India, either as parasites on the leaves or as causing decay of the wood, or again as saprophytic plants on the ground in the forests, is one which so far has made but little progress. Most forest officers, however, know how exceedingly important the subject is, and many of them have had opportunities of seeing what has been done in Europe to work it up, and most especially in Germany. The real pioneer in the study of forest-tree pathology was undoubtedly Prof. Robert Hartig of Munich, whose text book of the "Diseases of Trees," which is available to English students in the excellent translation of Dr. W. Somerville, revised and edited by Prof.^o Marshall Ward, F. R. S. (Macmillan & Co. 1894) is one of the most interesting works which a forest officer who observes the processes which are going on in the forests, inimical to forest tree-growth and development, can study. There is an excellent, if somewhat brief, account of the principal European tree fungoid diseases, by Mr W. R. Fisher, in the 4th Volume of Dr. Schlich's Manual of Forestry, and another in Prof. Marshall Ward's 'Timber and some of its diseases' (Macmillan & Co. 1889). But the most important and most astonishing book on the subject is the monumental work of Dr. Karl Freiherr von Tubeuf which has been translated into English by Dr. W. G. Smith of Edinburgh as 'Diseases of Plants, induced by Cryptogamic Parasites' (Longmans, Green & Co. 1897) a work which is practically a dictionary of all that is known on the subject and refers, not merely to European plants, but to the plants of the world and those of their fungoid diseases which have been so far discovered. A mere cursory examination of Dr. von Tubeuf's great work is sufficient to open the eyes of even the most conservative and sceptical of Foresters to the importance of the subject and to the amount of information which still remains to be obtained regarding it. It is clear that there is hardly a plant among the higher order that is not

affected by some, indeed often by many, parasitic and epiphytic fungi; and the wonder is that with so many foes, plants cultivated and wild and forest trees are able to maintain successfully their powers of growth and reproduction. So far as they were known at the time he wrote, Dr. von Tubeuf made mention of the Indian species.

It is fortunate that, so far as observations have yet gone, the chief forest trees of the hotter parts of India have not been found to be affected by injurious fungi to the same extent as are the forest trees of Europe and their allies of the Himalaya, but in the Himalaya the fungi are often very much in evidence and even in the plains there are some of considerable importance, a few examples of which may be given.

In January 1891, I visited the Changa Manga Plantation with the Forest School students who were on tour there under the supervision of the Deputy Director, Mr. Fernandez. Not far from the Forest and Canal Bungalows, in a low-lying rather damp area, many dead and dying trees were met with. On being cut into, the stems of these trees were found to be permeated in every direction by the white mycelium of a fungus. At first, we thought that possibly the fungus might be one of those species which attack only dead wood, but the presence of the mycelium in still living trees was against this, and after a considerable search, the sporophores of a large species were found, with every indication that they belonged to the mycelium in the wood. The sporophores consisted of a large, dark, red-brown, bracket, fixed to the tree at one side close to the root; the upper surface measured perhaps a foot to a foot-and-a-half in length and 6 inches or more in breadth, and showed several rings indicating its gradual growth. The spores were in tubes on the under surface in the manner characteristic of the *Polypores*, and the fungus, on being sent to Kew for identification, proved to be a new species and was described by Mr. G. Massee as *Polystictus egregius*. By some authors *Polystictus* is regarded as a section of *Polyporus*, that large genus of Hymenomycetous fungi which possesses so many members destructive to forest trees and timber in Europe, among which perhaps the most noticeable is *P. sulphureus*, which has sporophores very closely resembling those of the Changa Manga plant. Again, when on tour in 1889 in the Casuarina plantations of Nellore in the Madras Presidency, a similar case of dying and dead trees was observed, and the only specimen (a very young and imperfect one) which was obtained of the sporophore, was found to be very similar to the Changa Manga one and may very likely have belonged to the same species. In both cases, I remember to have very strongly urged the local officers to follow up the subject, and specially to study means for getting rid of the pest, but I have never since heard if anything more was done, and fear that *Polystictus egregius* is

still at work trying to ruin the beautiful plantations of Sissoo in the Punjab, and the Casuarina groves of the Madras coast. Of other *Polypori* the most noticeable perhaps is *Polyporus (Fomes) fomentarius*, which is everywhere conspicuous in the North-west Himalaya especially on the 'bán' oak (*Quercus inoana*) and the birch (*Betula alnoides*), the sporophores consisting of a huge, hard, grey, reversed bracket. This fungus, which thrives both on living and on dead trees, perhaps more frequently on the latter, is also common in Europe, where, up to quite recently, and indeed still to some extent, the dried sporophores are used for tinder. Many of us can still remember the 'amadou' matches which used to be sold in the cities of Europe for lighting cigars, and which were made of the dried felt of the sporophores of this species.

For many years, the parties who have visited the deodar forests of Jaunsar yearly for the instruction of the students of the Forest School, have been interested and puzzled by the groups of young dead deodar to be met with here and there, the cause of death being not at once apparent. Often have we dug up specimens, only to find what might have been expected, that the roots and the lower parts of the stems were fully permeated by the mycelium of some fungus, but *what kind of plant it was and what could be done to stop it we had no means of telling*. Last autumn, however (1898), spring searchings having invariably failed, I was in Jaunsar and took every opportunity of hunting for the sporophores and at last was successful in finding a rather poor specimen which was unmistakeably the cause of the death of a fine young deodar near the Jako pass. It was sent to Kew and proved to be *Polyporus (Fomes) annosus*, Fries, better known by the older name of *Trametes radiciperda*, Hartig, and described by Hartig as "undoubtedly the most dangerous of all the parasites met with in coniferous woods, not only because it produces the worst kind of red-rot, but also on account of its being the most common cause of gaps in both young and old plantations." It is impossible to exaggerate the importance of this sad discovery. The Forest Department is very properly yearly spending on the reproduction of deodar large sums of money and so far the success has on the whole been considerable, better perhaps with natural than with artificial reproduction, but still good in both cases. In Jaunsar and in the neighbouring leased forests of Tehri-Garhwal, the disease is, so far as my own observation goes, on the increase, and it is now time to take strong measures to stop it before it goes too far. It is propagated, as is well known and as is described by all the writers on the subject, Hartig, Marshall Ward, Fisher, von Tubent, chiefly by the contact, in the soil, of the roots of adjoining trees and the remedy proposed, and for long adopted in Germany, is to isolate affected trees or patches of trees by digging trenches around them sufficiently deep to prevent their roots

passing beyond and communicating the disease to neighbouring trees. Further details must of course, be worked out on the spot, but I strongly advise early action or the spread of the enemy may be too quick and we may lose some of our finest and most promising areas of reproduction.

These few examples ought to show sufficiently clearly how very important the subject is, and if we are to utilize to the full the information obtained in, and the experience of, Europe, we must begin by searching for and finding the sporophores and obtaining their identification. The identity of the fungus which attacks the stems of the Kharshu (*Quercus semecarpifolia*) trees at Deoban in Jaunsar, requires to be investigated. From the fact that it is apparent both in the mycelial form of white threads disintegrating the wood, and in the form of long black stout rhizomorphs it is most probably the well-known *Agaricus melleus* or an allied species, but the discovery of the sporophores is necessary in order to settle the question.

In the case of Hymenomycetous fungi like those already mentioned, it is not always easy to find the sporophore and identify the enemy; but in other cases, and especially in the case of the leaf-diseases, it is not so difficult. Most of those who have worked in the sub-Himalayan sâ forests have noticed that in some years the leaves of the trees, often over considerable areas, appear as if covered with soot. A very little examination of the effected leaves shows that the black appearance is due to a fungus, but although the spores of the fungus were readily found, its nature remained for some time in doubt. Specimens collected by myself in Dehra Dun and by Pandit Keshavanand in the forests of Oudh were sent to Dr. D. D. Cunningham, F. A. S., of Calcutta, and his report was that the blight was a "Meliolaceous" Pyrenomycete.... not parasitic but merely epiphytic and that 'where they do any injury to the host, it is purely due to their interfering with assimilation and respiration from the dense surface-coating which they ultimately tend to form.' A note on the subject appeared in the "Indian Forester" Vol. XX, p. 156 and further specimens were sent to Kew where they were identified as *Meliola amphitricha*, Fries. Thus two investigations were satisfactory and showed that after all, unless the fungus was very bad indeed, it was not to be expected that it would cause greater injury to the sâ forests than a slight retardation of growth. So is it also, generally, with the well-known conspicuous orange-coloured uredineous fungi which occur on the leaves of Himalayan conifers and which were the chief subject of the paper in the "Indian Forester," Vol. XXI, p. 126, by Mr. J. Nisbet, with pictures from photographs taken by Mr. C. G. Rogers. The chief of these was the yellow tassel-like fungus on the young leaves of *Picea Morinda* called by Mr. Nisbet *Ecidium Thompsoni* and iden-

tified at Kew as *Peridermium incarcerans*, Oke. and by Barclay as *P. piceæ*, Barcl. This bright-looking fungus is, as Mr. Nisbet pointed out, closely allied to the *P. coruscans*, Fries, which attacks the spruce tree of Europe and is occasionally eaten by the peasants in the north, and I believe it is itself occasionally used as an article of food in the Himalaya. The damage done by it is not very great unless it happens to attack the principal leading shoot of the tree. Then there were also the Peridermia of the pines, *Pinus longifolia*, and *P. excelsa*, identified at Kew as *Peridermium orientale*, Oke. These appear as small orange-coloured sacs of spores on the needles of the trees here and there, but do little harm unless they occur, as Mr. Nisbet points out, on the branches in the form of the var. *corticola*. They have been described, in more detail, in Mr. Nisbet's paper already referred to, as well as in Dr Cooke's paper in the "Indian Forester." Vol. III, p. 88. The *Peridermium pini* of Europe, which is found on the Scots pine, is known to be in its leaf-attacking variety the æcidial form of *Coleosporium senecionis*, a fungus which attacks the groundsel, but the corresponding alternate plant of the *P. orientale* has not yet been discovered and here there is some scope for the investigator. As regards the alternate form of the var. *corticola*, Hartig says:— 'It is to be regretted that so far the plants have not been determined on which the teleutospores are produced. Until we discover the teleuto form, preventive measures must be confined to felling pines that are attacked.' Dr. Barclay thought that the forms on *Pinus longifolia* and *Pinus excelsa* were distinct, and named them, respectively, *Æcidium complanatum*, Barcl. and *Æ. brevius*, Barcl. (see Jour. As. Soc. Beng. lix. ii. 101-102). He thought at one time, that the latter might possibly be the æcidial form of *Chrysomyxa himalayensis*, a bright orange-coloured fungus very common on the petioles of the leaves of *Rhododendron* trees in the hill forests, but afterwards changed his mind and considered that the alternate host of the latter would more probably be *Picea Morinda* and the fungus *Æcidium piceæ* (see Scientific Memoir of Medical Officers of the Army of India, Part VI, 1891, p. 71.)

An interesting example of alternate generations in fungi is given by Dr. Barclay in the same Scientific Memoir, Part V 1890, p. 71, where he shows that the *Gymnosporangium Ounninghamianum* which grows on *Cypressus torulosa*, Don, has its æcidial form on the wild pear *Pyrus Pashia*. The cypress fungus is that one which may be seen in abundance about Bodiyar in Jaunsar, having, in wet weather, the form of gelatinous yellow masses. Nisbet in the 'Indian Forester,' XXI, 182, speaks of these as a *Nostoc* or *alga* but this is not mentioned by Barclay.

Another example, perhaps the best known example, is that of the 'rusts' of wheat and other cereal crops and

grasses. A very full account of these rusts was published in 1897 by Dr. Prain of the Royal Botanic Gardens, Calcutta, in 'Agricultural Ledger' No. 16 in which he explains how, among others, the 'Black rust' (*Puccinia graminis*) which attacks wheat, oats, barley and rye, as well as other grasses, has its æcidial stage on species of barberry (*Berberis*); the 'Brown rust' (*P. dispersa*) which attacks wheat and rye and other grasses has its æcidial stage in various species of the 'Borage' family; and the 'Crown rust' (*P. coronata*) which attacks chiefly oats and other grasses has its æcidial stage on various Buckthorns (*Rhamnus Berochemia*, etc). Dr Prain explains how it is not yet known exactly whether the common rusts of India have their æcidial stages on other plants, and if so, what plants these are, but we do know that æcidia of a fungus which has at Kew been identified as *Puccinia graminis* has been found on *Berberis aristata*, that *Puccinia coronata* has been identified as attacking *Rhamnus purpureus* and *virgatus* and that a fungus described by Mr. Barclay as *Uredo ehretia* has been found in the Himalaya attacking the Boraginous tree *Ehretia serrata*, and may be possibly identical with *Puccinia dispersa*; so that there is every reason to think that, at any rate, in the neighbourhood of the north-west Himalaya the principal rusts of the cereal crops are traceable to the leaf-fungi of Himalayan forest trees and shrubs.

The pages of the 'Indian Forester' contain several articles of interest on the subject of Indian parasitic fungi, and more especially can we draw attention to Dr. M. C. Cooke's admirable papers in Vol. II. p. 380; and Vol. III. p. 14. Dr. Cooke was also good enough to name for me some specimens collected by myself and others, and these are mentioned in Vol. IV. page 90 and page 197.

The chief workers in the field of the Indian fungoid diseases of plants have been Dr. D. D. Cunningham, F. R. S., who has lately retired from service in broken health after many years of hard work in Calcutta; and Dr. A. Barclay who died in 1891 at Simla of typhoid fever at the early age of 39, to the great regret of his many friends and correspondents, and to the great loss of Indian scientific work. A notice about him and his work will be found in the "Indian Forester," Vol. XVII. page 303.

It may be well here to mention a few of the species which attack forest trees, which were described by Dr. Barclay, chiefly in the Journal of the Bengal Asiatic Society.

- | | |
|-------------------------------|---|
| 1 on <i>Berberis aristata</i> | the rust <i>Puccinia graminis</i> , Pers. |
| 2 on <i>Hypericum cernuum</i> | the yellow <i>Melanospora Sanotis Johannis</i> , Barcl. |
| 3 on <i>Rhamnus daharicus</i> | the rust <i>Puccinia coronata</i> , Corda. |
| 4 on <i>Fittia himalayana</i> | <i>Uredo cronartiformis</i> , Barcl. |
| 5 on <i>Acacia eburna</i> | <i>Æoidium esculentum</i> , Barclay. |

The attacked twigs are eaten in the Poona District, as reported by Mr. R. C. Wroughton—see Pro. Bomb. Nat. Hist. Soc., Vol. 2.

- 6 on *Rosa maritima* *Puccinia Rosa*, Bazol.
 7 on *Rosa moschata* *Phragmidium subcorticium*, Sehrad.
 8 on *Rubus lasiocarpus* *Phragmidium Rubi*, Pers.
 9 on " *biflorus* " *ginguuloculata*, Barol.
 10 on " *paniculatus* " *incompletum*, Barol.
 11 on *Pyrus variolosa* *Gymnosporangium olavariforme*, Jaq.
 the alternate form of this probably comes on Juniper.
 12 on *Pyrus Pashia* *Gymnosporangium Cunninghamianum*, Barol.
 alternate form on cypress, see above.
 13 on *Cytisaster bacillaris* *Gymnosporangium Cunninghamianum*.
 14 on *Aspidosiphon rivularis* *Xenodochus Clarkianus*, Barol.
 very common—spores bright yellow on the leaves.
 15 on *Deutsia corymbosa* *Uredo Deutsia*, Barol.
 16 on *Rhododendron arborescens* *Chrysomyxa himalayensis*, Barol.
 17 on " *lepidotum* *Uredo* sp.
 18 on " *campanulatum* *Aecidium* sp.

It is supposed that these latter may all be connected in some way, but the question still requires solution. But it seems more probable that the first has its alternate stage on *Picea Morinda*.

- 19 on *Jasminum humile* *Aecidium Jasmini*, Barol.
 20 on " *grandiflorum* *Uromyces Cunninghamianus*, Barol.
 21 on *Ichnocarpus frutescens* *Uredo ichnocarpi*, Barol.
 22 on *Ehretia serrata* *Uredo ehretiae*, Barol.

On this see also "Indian Forester" XVIII. 21 and above.

- 23 on *Colebrookia oppositifolia* *Uredo Colebrookia*, Barol.
 24 on *Ficus palmata* *Aecidium Mori*, Barol.
 25 on *Morus serrata* *Oozonia Mori*, Barol.
 26 on *Populus ciliata* *Melampsora ciliata*, Barol.

This is a light yellow fungus found on the leaves, the white one which makes the leaves look as if powdered with lime being *Uncinula salicis*.

- 27 on *Populus alba* *Melampsora aecidioides*, Barol.
 28 on *Pinus longifolia* *Aecidium complanatum*, Barol.
 29 on *Pinus exotica* *Aecidium brevius*, Barol.

Both these species are now united as *Aecidium orientale* as already described.

- 30 on *Picea Morinda* *Aecidium Thompsoni*, Barol.
 31 on do. *Aecidium piceae*, Barol.

on these, see previous remarks.

- 32 on *Cedrus Deodara* *Aecidium Cedri*, Barol.

This forms small yellow spots, and the leaves turn yellow, bend down and fall off, but the damage done is not great.

Since Dr. Barclay's work, little or no original work has been done in India on the fungi which attack forest trees, but many specimens have been collected and sent to Kew for naming and the first instalment of these was published in the Kew Bulletin for June 1898. The chief of these which are parasitic on forest trees are:—(1) *Gambusia cornuta*, Massee, which occurs as black tufts on the leaves of *Berberis nepalensis* and is very common about Ohakrata, and (2) *Melampsora epitea* Thüm., which is found as yellow masses on the under surface of leaves of *Salix elegans*. Others have also been named and will doubtless appear described in future numbers of the Bulletin; among

them may be mentioned : *Exobasidium cinnamomi* Massee, the remarkable growth on the branchlets of *Cinnamomum Tamala* referred to in Mr. Nisbet's paper ("Indian Forester," Vol. XXI. p. 133) as *Exoascus* and producing a large bushy kind of witches' broom, seriously deforming the branches of the trees. It was found near Thadyar in the Tons valley ; (2) *Stereum lobatum*, Kunze, a large hard fungus found on oaks (*Quercus dilatata*) in Jaunsar ; (3) *Rosellinia spadicea*, Cesati, a black fungus found on the lower part of the old culms of *Arundinaria spathiflora* ; and (4) *Trichosporium aterrimum*, Massee, a curious black species which apparently does considerable damage to mulberry trees in Changa Manga. It was discovered by Mr. F. Gleadow.

Besides the parasitic species, there are many interesting fungi attacking dead wood. One of the most noticeable of these is the scarlet *Polystictus sanguineus* Fries, so common in the sâl forests ; the prettily-shaded *Polystictus versicolor*, Fries, is also abundant in sâl forests on dead bark ; *Hymenochate Mongeotii*, Cooke, is a dark red fungus, occurring in large patches on the outer bark of *Betula alnoides* in the Himalaya. *Lentinus, omphalomorphus*, Mont. and *Davalea Schomburgkii*, Berk. are white fungi conspicuous on sâl logs. *Hydnum Gleadovii*, Massee, is a beautiful sponge-like fungus of similar situations.

It has only been possible to mention a few of the many kinds which have been discovered of recent years. Specimens of most of them are deposited in the Museum and Herbarium at Dehra Dun, but there is much more yet to be done, and the chief object of this paper is to urge Forest Officers to collect specimens and send them for identification through the Director of the Forest School, where duplicates should always be kept, allowing the originals to be retained at Kew. I feel sure that the Director of Kew will be very glad to assist in obtaining names, and that Mr. G. Massee will be delighted to continue to publish such new species as he may find among the collections sent. The information obtained cannot fail to have an important bearing on forest management especially on that of the forests of conifers of the N.-W. Himalaya, and by degrees materials can thus be collected towards a Handbook such as it is obviously desirable that we should possess. Leaf fungi can be collected and dried like ordinary Herbarium specimens, larger species can be merely dried loose and packed in paper. It is of the utmost importance to give full information and notes, and above all, to give the name of the plant upon which the fungus is found.

II.—CORRESPONDENCE.

Is Poinciana elata a wild tree in India ?

Can any of your correspondents in 'Southern or Western India give any definite information on the above question ? Roxburgh mentions *Poinciana elata* as "a native of Coromandel" but though I have made journeys through most of the forests of the Coromandel coast from the Mahanadi to Madras, I have never seen it wild. Beddome speaks of it as "rare in our jungles, though met with in the forests of both the Eastern and Western coasts." Brandis says "indigenous in forests of the Eastern and Western coasts of India as far north as Guzerat," Talbot quotes Brandis which looks as if he had never seen it himself in a wild state in the Bombay forests. In Balfour's 'Timber Trees' it is said "this willow (*sic*) grows in Malabar and is much planted all over the Madras Presidency," which latter remark is quite true for it is a common avenue tree in places as in the Cuddapah and Bellary districts. But it is, I believe, a *dry* country tree and so unlikely to be wild in Malabar. Can anybody very kindly afford information to settle the matter ? A specimen of the wood, whether from a wild or cultivated tree is immaterial, would be greatly appreciated, to be described in the 'Manual of Indian Timbers.' A quite small piece would amply suffice, say, 3 in. \times 2 in. \times $\frac{1}{4}$ in.

Liss, Hants, England.

J. S. GAMBLE.

The Director of the Forest School would also be very grateful for a somewhat larger specimen for the Forest School museum, and would bear the cost of carriage. HON. ED.

Early flowering of Butea frondosa.

I send you herewith some flowers of Palas (Dbak) (*Butea frondosa*) collected in the Amraoti Hills Range on the 13th October 1899. This so very early flowering is on account of the heat due to the utter failure of the last moonsoon. These scarlet flowers usually appear in February and March. This year the flowering has been nearly four months earlier than the ordinary years.

AMRAOTI, }
18th October, 1899.

MANSUKH RAI.
E. A. C., Forests.

The Indian Forest Service Colours.

Can you kindly state definitely for the information of the Department whether the new Forest Colours are for the whole Service or only for the Imperial Branch, as there seems to be a little doubt on the point, and it would be a pity if Provincial Service Officers were led to invest a considerable sum in colours which they would after all not be able or wish to wear.

P. R. O.

NOTE—It has always been understood that the new colours are for the Imperial Branch only. HON. ED.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Sale of Rubber from the Charduar Plantation in Assam.

The Assam Forest Department sold in London the first produce of the Charduar Rubber Plantation @ Rs. 2-8-6 per lb.

The cost of transport from Tezpur and agent's and sale expenses amounted to Rs. 0-3-7 per lb.

We were offered in Tezpur Rs. 1-14-6 per lb.

By sending it direct to the market we profited Rs. 0-6-5 per lb.

The total net profit was Rs. 1-2-6 per lb. but this is of no special interest, as the cost of collection was rendered exceptionally high by inexperience and bad weather.

Mechanical Tests of Anan Wood.

(*Fagraa fragrans*).

Letter dated the 3rd of October 1899, from the Executive Engineer Rangoon Division, to the Superintending Engineer, South-Western Circle.

With reference to your No. 8369, dated 21st ultimo, I have the honour to state that before submitting an estimate for procuring samples of Anan wood large enough for satisfactory tests and for carrying out such tests, I thought it advisable to procure small specimens so as to get without cost, a general idea of the wood and its character.

2. For this purpose I obtained from the Conservator of Forests, Tenasserim Circle, a few specimens 9"×1"×1" and 9"×3"×1/5" and I now forward results of observations and I think you will agree that it is well worth the small expense of thorough testing. I am sorry I shall be unable to carry these out myself as I hope to proceed on leave shortly, so if you wish, I will submit an estimate for procuring and testing the wood.

3. (a) *General*.—Extra Assistant Conservator of Forests, South Tenasserim Division, in his No. 132-136 dated 15th June 1899, writes :—

- (1). "Anan (Tavoy anyin) *Fagraa fragrans*, 198 Anan logs have been extracted during the past three years by consumers and purchasers. No timber of this kind has been worked out yet departmentally."
- (2). "The Anan tree is found scattered over this and the Mergui District and is most plentiful in the forest round the Heinze basin. I am inclined to put down the outturn from these forests at 200,000 tons."
- (3). "The timber from the Heinze and Endayaza forests, can be worked down to Heinze basin or Tavoy up to a length of 60 feet."
- (4). "The price at which this timber could be supplied at Tavoy in round logs is Rs. 40, sawn timber from Rs. 50 to Rs. 60 per ton according to length required. This does not include freight to Rangoon and other shipping charges."

(b). *Durability and freedom from attack of insects.* The same officer in the same letter writes :—

(5). "From information available I consider Anan timber to be the most durable of all timbers either in India or in Burma and it is one of the few timbers which the teredo does not attack. For example :—

(a). "Three bridge posts in the Kaing *chaung*, Myohaung (old Burmese town of Tavoy) said to be over 200 years old. Sample of wood from these posts forwarded with this letter."

(b). "Four bridge posts in Seinyat *chaung* (salt water) near Onbinkwim village, said to be over 200 years old."

(c). "Three bridge posts in Kyonsat *chaung* (salt water) said to be 200 years old."

(d). "The posts in the moat of the old city of Tenasserim 300 years old."

6. "Besides this I have seen posts in *pdygyi-kyau* at Pynpygyi and other places, from 15 to 100 years old. All the above posts are still standing."

(c) *Weight.*—In 7 specimens the specific gravity varied from 0.898 to 1.049, with an average of ... 0.962

Molesworth gives average for English Oak ... 0.855

Teak ... 0.800

English Ash ... 0.720

The weight per cubic foot varied from 55.75 to ... 65.75

With an average of ... 60.06

Molesworth giving for English Oak ... 53.00

Teak ... 50.00

English Ash ... 45.00

Specimens thoroughly dried lost 5.15 per cent of their weight and immersed for 48 hours absorbed from 4.85 per cent of their weight for flat pieces to 2.07 per cent for those of square section.

(d) *Exposure.*—Flat specimens exposed to the full rays of the sun showed no signs of warping or cracking.

(e) *Tensile strength.*—This could not be tested as the specimens were too small to stand the grip of the machine.

(f) *Crushing.*—The specimens 4 in. by 1 in. by 1 in. were crushed under weights of 9,744 lbs. and 8,624 lbs. respectively, giving an average of ... 9,184

Molesworth gives Teak ... (max) 12,000

English Ash ... (average) 8,950

English Oak ... ,, 8,200

(g) *Transverse strength.*—One specimen 11 in. by 1 in. section between 6 in. centre broke under a load at centre of 17.5 cwt.

This gives a transverse strength of ... 2,980

Molesworth gives English Ash ... 2,500

Teak ... 2,110

English Oak ... 1,645

(h) To test its suitability for wood paving the Municipality is laying down a strip 10 feet long beside similar strips of other woods.

4. It is a fine grained handsome wood and should be suitable among other things for joinery.

5. I send herewith one sample of the square and flat specimens.

The late M. Nanquette.

On the 30th August last the Foresters of France bade a long farewell to the remains of their, and our, honoured friend and teacher, Henri Nanquette. He was buried at his native place, Revin, in the Ardennes, where he had spent in domestic and social felicity the years preceding his death.

The Government was represented by M. Fétet, Administrateur des Eaux et Forêts, and by M. Lafosse, chief of the staff. There were also present M. Dérné, Conservator of the 6th Arrondissement, M. Guyot, Director of the Forest School, M. Fliche, Professor at that Institution, and every Forest Officer who could reach the place in time to join in the last act of homage to the illustrious deceased. The speeches were pronounced by M. M. Fétet, Guyot, and Dérné, and bore testimony alike to the skill, the firmness under difficulties, the sympathetic influence, the tact and energy, the simple dignity of character, and the successful life of the late Inspector-General of Forests.

M. Nanquette entered the Forest Service in 1836. In 1845 he became Inspector of Studies at the Nancy Forest School. In 1860 he became Sub-Director and Professor of Forest Economy, In 1864 he was made Director. In 1875 he became an Officer of the Legion of Honour. In 1880, in the height of his success, he took his pension with the rank of Inspector-General, preferring to retire while he was still able to enjoy life and was sure of finding crowds of friends in his native place. It is not too much to say that the period of his administration covered the palmiest days of the Nancy School. His teaching is to some extent embodied in his books, "*Cours d'Aménagement*" and "*Exploitation des Bois*," which are still among our classics. It is true that the printed word remains permanent, but the spoken word, for those privileged to hear it, is what brings us face to face with nature and enables us to understand her varying moods and ever-changing needs. There are, those who feel intuitively the right course, and of those M. Nanquette was one, but the gift was backed by keen observation and the power of accurate deduction. He took an active interest in forest questions till the last, and his loss, a severe one for France, will not be unfelt in the remotest parts of India and Burma.

IV.—REVIEWS.

Forest Administration in Burma during 1897-98.

From a financial point of view the year 1897-98 was an eminently successful one, the gross receipts being Rs. 72,15,257 and the surplus Rs. 50,18,649 which is the highest yet obtained. Of the former Lower Burma contributed Rs. 41,71,929 and Upper Burma Rs. 30,37,911, the Eastern Circle coming first with a revenue of Rs. 22,16,126. The surplus stock of girdled trees in this circle is however nearly worked out and a heavy fall in revenue must be expected in the immediate future.

Excellent progress also has been made in other respects. An area of 799 square miles was added to the reserved forests, 798 square miles were enquired into by Settlement Officers, and further projects for the reservation of 4,300 square miles were under consideration. The total area of reserved forests at the close of the year was 14,707 square miles, of which 849 square miles are burdened with taungya privileges.

In regard to certain areas in the Pegu Circle taken up as fuel reserves under the Land Acquisition Act or reserved under Act VII of 1865, the Conservator remarks:—

“A number of the forests included in Form 46 as reserves have never been legally constituted reserved forest, neither have they been formally and definitely settled. Some of them have been acquired merely under the Land Acquisition Act without minute enquiry into, and settlement of, rights. The administrative history of each forest and its title to be classed as a reserve are now in course of investigation, and as soon as the necessary information has been collected, proposals for formal reservation will be submitted to Government in respect of such forests as may be found to require it. Forest settlement proceedings in regard to such forests will probably prove to be simple and expeditious, as the forests themselves have since many years been treated as reserves and no claims to rights within them appear to have been advanced.”

He appears to have lost sight of section 30 of the Burma Forest Act which makes the legal status of these reserves perfectly clear.

Demarcation is well advanced except in the Western Circle, where work was postponed in order to push on the valuation of the forests.

The Survey of India completed the survey of 182 square miles of reserved forests on the 4 inch scale in Shwegyin and 224 square miles in Pegu, as well as the traverse survey of 656 square miles in Pegu and Thayetmyo, and in addition surveyed on the 2 inch scale, 118 square miles of unreserved forests in Toun-goo and 152 square miles in Shwegyin. The Forest Survey party in the Ataran Division completed on the 4 inch scale

the detail survey of 164 square miles and 42 miles of boundary. A second party of the same survey completed the triangulation of 804 square miles in the Ruby Mines Division, and in the Pyinmana Division the detail of 366 square miles, both on the 4 inch scale, besides traversing 241 linear miles. Surveys by local officers covered 972 square miles.

Two Working Plans parties were employed, one in the Tenasserim Circle and one in the Pyinmana forests of the Eastern Circle. The outturn of work for the year was; Plans completed, Tenasserim Circle, 40 square miles; Eastern Circle, 60 square miles; Plans under compilation, Tenasserim Circle, 207 square miles; Eastern Circle 207 square miles. The total area of reserved forests for which working plans have been completed or were under compilation at the close of the year was 1,508 square miles in Lower Burma and 406 square miles in Upper Burma, leaving respectively, 5,623 and 7,024 square miles still to be taken in hand. Working Plans operations in Upper Burma have been mainly concentrated in the Pyinmana forests, for which alone reliable maps have been completed. On this point the Government of India remark: "This is in a measure to be regretted, for the reason that these forests have been so much over-worked in the past that for many years to come they can only be expected to give a fractional part of their normal yield. Their treatment in the immediate future must consist of careful protection and such husbanding of the existing crop as will restore the growing stock to a normal condition, and with this object in view, rough plans would have sufficed, while more elaborate working schemes were being prepared for the forests still rich in mature teak." But we believe that at the time when surveys were started in Pyinmana, settlement and demarcation were not yet sufficiently advanced in the forests last referred to.

In the Western Circle linear enumeration surveys, with a view to ascertain the possible yield of the forests in teak and determine a safe limit for future girdling operations, were undertaken on a very large scale, the total area enumerated being 67 square miles and the proportion counted over varying from 1.2 to 2.2 of the various forests. "Such a season's outturn reflects the greatest credit on all the officers engaged, who, without a single exception worked, often under very difficult conditions, with untiring energy and a praiseworthy determination to carry through the entire programme."

The forest offences for the year are classified as follows:—

		Lower Burma	Upper Burma	Total
		cases.	cases.	cases.
Taken into Court	...	261	203	464
Compounded	...	2,133	341	2,474
Undetected	...	25	24	49
<hr/>		<hr/>		
TOTAL		...	2,987	

More than 80 per cent. of the cases prosecuted resulted in convictions. Information as to the amount of compensation accepted in cases compounded is only given for the Pegu and Western Circles in which the amount was Rs. 5-12-7 and Rs. 12-11-4 per case respectively.

In regard to fire-protection we cannot do better than quote the orders of the Government of India on the report.

"The inefficiency of fire-protection in Burma has several times been brought to prominent notice, and, although the report under review is so far satisfactory that the areas attempted and actually protected have been increased and the cost-rate reduced, still much remains to be done, as will be seen from the following tabular statement:—

Circle.	AREA IN SQUARE MILES.			Proportion of failures to area attempted.	Cost.	Proportion of area under fire-protection to total area of forests in charge of Forest Department.
	Attempted.	Failures.	Protected.			
				Per cent.	Rs.	Per cent.
Pegu	502	43	459	8.5	57	15.51
Tenasserim	562	2	560	0.3	37½	13.58
Total Lower Burma ...	1,064	45	1,019	4.2	48	14.43
Eastern	512	85	427	16.6	19½	19.26
Western	488	178	310	36.5	19½	10.43
Total Upper Burma ...	1,000	263	737	26.3	19½	13.63
Grand Total, Burma...	2,064	308	1,756	14.9	35½	14.03

"The most noticeable feature, when compared with the great progress made in other branches of forest administration, is the small percentage of the forests over which fire-protection is attempted. In round figures it is less than 15 per cent in Lower Burma and than 14 per cent in Upper Burma. Then, the want of success, more particularly in Upper Burma where the percentage of failures was 57.7 in 1896-97 and 26.3 in 1897-98, is remarkable. It is possible that there has been a tendency to spend less money in Upper Burma than is necessary to insure efficient protection, since the cost has been much less there than in Lower Burma; but it is better to spend the higher rates to obtain immunity from fire, than to risk the loss of all benefit and waste of the entire expenditure by having the whole area burnt over every two years, which is the result when failure extends to 50 per cent. of the area attempted."

"Now that the demarcation of reserves is so far advanced and their protection from encroachment assured, it is essential for their improvement, as well as for the maintenance of that yield which is expected of them, that they should be protected from fire, and the Governor-General in Council desires that adequate measures and a sufficient outlay to afford them continuous protection may be arranged for. Until the forests come to be successfully protected from fire, any attempt to improve them by the introduction, naturally or artificially, of a larger proportion of teak by the cutting out of inferior species, or by any other means, is futile."

The difficulties in regard to fire-protection are mainly due to the insufficiency of the subordinate establishment and to the scarcity of labour. The remedy for the former is obvious and the latter will probably have to be met to a considerable extent by employing imported labour.

The area of Taungya plantations in Lower Burma was increased by 3,787 acres, of which 1,243 acres were planted with cutch. The cost amounted to about Rs. 10 per acre. Some small areas were also planted in Upper Burma. Weeding and cleaning of older plantations in the Tenasserim Circle was carried out over 7,676 acres at a cost of Rs. 14,667, and in the Pegu Circle Rs. 35,760 were spent on the same work, but the area operated over is not given. In the Pegu Circle 2,058 acres of plantations were thinned. The thinnings from the Prome teak plantation of 1858 (73 acres) sold for Rs. 1,274, and in the Rangoon Division Rs. 1,105 were realized, but elsewhere the thinnings were unsaleable.

We notice that Forest Officers appear to be now in favour of a spacing of 6 feet by 6 feet in plantations instead of 9 feet by 4 feet. This is a reversion to a system that was deliberately abandoned, as it was considered that the 9 feet by 4 feet planting, besides facilitating weeding, shortened the struggle between individuals and enabled the dominant trees to assert themselves at an earlier stage, thus to a great extent obviating the necessity of early thinnings.

Improvement fellings with a view to encourage the growth of teak were carried out over 10 square miles in the Tenasserim Circle, and 46 square miles in the Pegu Circle, the cost of the latter being Rs. 285 per square mile. Operations of a similar kind covered about 2 square miles in Upper Burma, exclusive of climber cutting.

The Conservator, Pegu Circle, compares the results of certain dibblings of teak seed accompanied by improvement fellings executed in the Kangyi reserve in the seventies with those of the Taungya plantations of a similar age, and with sowings in flowered bamboo areas, and draws conclusions entirely in favour of the first. But there is really no comparison possible between the three methods. The first is as a rule only possible in forests with little or no bamboo like Kangyi and such areas are very few

and far between. The teak taungya system no doubt affords the best means of dealing with old Pônzo areas in which seed trees are generally insufficient. Sowing in flowered bamboos have so far been of an experimental nature; and it has not yet been ascertained what can be done in that direction. The most successful operations of this nature are those in the Bwet reserve, made in 1881 and following years. In this case the whole of the reserve, which was a mass of dead bamboo culms resulting from a flowering which probably took place in 1879, was accidentally burnt through in 1881. The initial cost of the first plantings, which were made immediately after the fire, was about Rs. 4 per acre and the total cost of the 600 acres estimated to have been actually planted is shown in the Annual Report of 1891-92 (the latest in which it can be traced as a separate item) as Rs. 8,514 or about Rs. 14 per acre, while Kangyi figures in the same report as 350 acres costing Rs. 1,946 or Rs. 5.9 per acre. The areas given are only based on very rough estimates, but there is no doubt that the Bwet plantings have cost very much more than those in Kangyi (the former are probably also better stocked) and that this is entirely due to the various weedings and cleanings rendered necessary by the dense growth of young bamboos, which in Kangyi, which is principally tree forest, were not required. It is questionable, however, whether it would not have been advantageous to have abandoned to nature the less promising portions of the Bwet plantings, thus reducing considerably the cost of maintenance.

The Conservator rightly condemns the plan of felling all trees other than teak, on areas of flowered bamboo. In an ordinary forest with bamboos in Burma, the average number of trees, other than teak of 3 feet girth and upwards does not exceed 15 per acre and the small amount of shade these trees afford is rather beneficial than otherwise. It is quite early enough to remove them when the young growth has become fully established.

Girdling of teak trees for future extraction amounted in Lower Burma to 13,859 in trees reserves and 8,848 outside reserves. In Upper Burma only 2,861 trees were girdled.

	Lower Burma cubic feet.	Upper Burma cubic feet.	Total cubic feet.
By Government ...	2,004,194	1,281,209	3,285,403
„ Purchasers ...	16,455,713	20,570,428	27,026,141
„ Free grantees } and right-holders }	230,702	17,545,575	17,775,277

TOTAL ... 18,690,609 39,396,212 58,086,821

The estimate of timber removed from Government forests without payment must, however, be very much below the reality, especially in Lower Burma.

The total value of minor forest produce extracted was:—

Bamboos	...	...	Rs.	260,615
Grass and grazing	...	...	"	125,032
Other minor produce	...	...	"	211,262

TOTAL ... 596,909

But here again the full free consumption is no doubt not included. The revenue received from rubber and catch both decreased.

The total amount of teak timber extracted by lessees (almost entirely from Upper Burma) was 257,517 tons, yielding a revenue of Rs. 2,812,660 or something under Rs. 11 per ton, whereas in the Eastern Circle the net revenue from teak timber worked out by Government Agency was nearly Rs. 32 per ton.

A much-needed vernacular school for the training of Forest Subordinates has been established at Tharrawaddy.

V. SHIKAR, TRAVEL &C.

Another Exploit of my Bull Terrier.

The Editor of the "Forester" was so kind as to think my story of one of the adventures of my bull terrier and self worthy of publication, that I am tempted to send another, the more so as this story is more to her credit than the one relating to her turn up with the wild tusker.

One hot weather my assistant P. and self were out inspecting fire-lines and trying to ascertain how much of the Reserve had been burnt over by a particularly disastrous fire that had run through some time previously. On arrival at a small village near the Reserve two old friends of mine turned up beaming, in fact, their costume would have almost justified the reporter's phrase that they "were clothed with smiles" as they had jolly little else on. The men, Maung Shwe and Maung Kyaw, had been my companions in many a weary tramp, sometimes crowned with success and sometimes not, after bison, hsaing and all the deer. They thought I had come for no other purpose except shikar, and visions of heaps of dried meat floated before them. Had not two Forest Officers come to camp at their village, one of whom was a very old friend?

They partook of lemonade before an admiring and envious crowd returning thanks in a way not usual in polite society, but which was a very good advertisement of the gasiness of the fluid. Then having each lit a big white fat cheroot, they proceeded to inform me that hsaing were plentiful on the old kwins, and "thakin a herd of bison, over thirty at least, come out of the Fairies wood every day, morning and evening, to eat the tender grass shoots in the Indaing, and the old big bison male, the solitary one, he also sleeps daily in the Fairies wood. It is evident he wishes to die, coming here at the same time as my lord," and Maung Shwe looked round approvingly as there

was a low chorus of "hòkth" (It is true) from the squatting throng. P, whose first year out had not come to an end, was anxious for a try at something, so I lent him my 500 Express and taking my 12 bore Paradox next morning we started off betimes, P going off to the hsaing ground and self to look for tracks round the Fairies wood (Nat tau) a thick patch of evergreen unburnable jungle just outside the reserve and about 3 miles from the village. Tracks all round were very plentiful, in fact too much so, and it was next to impossible to distinguish the fresher ones from those a few days old. We wandered about being continually baffled till the April sun got too much for me, so going off to a nullah we camped under a bank near a fetid pool into which the bull terrier wallowed and lay gasping. The weary hours passed somehow, the two Burmans slept, I was going to say peacefully, but emitting a noise like a pair of well-fed bull frogs hardly fits the term; the afternoon at last began to wane, the joker who wrote the story about the land of Cockayne, where it was always afternoon, had evidently not been in Burma in the hot weather, if so, he would not have written such rubbish or anyway his bill of fare wouldn't have included roast *moorgi*. I stirred the Burmans up, and about 5 o'clock we made our way cautiously back towards the Fairies wood; we were creeping along the edge and just going up the steep bank of a nullah when Maung Shwe, who was leading, dropped back as if shot. I grabbed the terrier and taking off my topee, peered over a small kwin (area devoid of trees); there, grazing on the new shoots of elephant grass, were 13 bison; the new grass was about 3 feet high so the stalk (as there was no wind) to a "*Butea frondosa*" tree about 30 yards from the lot wouldn't be difficult. I whispered to the men to hang on to the dog till they heard a shot and then let her go. I then started crawling on my hands and knees towards the tree, the thick burnt stems of the grass gave my hands and knee caps beans so I was thankful to reach my point; getting into an erect position I looked round, the beasts had grazed away from me except one, to the left near the wood, which was only about 60 yards away and head on.

I took a careful plug at the shoulder, and the change! Every animal threw up its head and started rushing for the shelter of the jungle streaming across my front. I tore across an open strip diagonally to cut them off and got a beautiful shot in at one and then dashed after them. About 6 yards inside the jungle I came on the animal shot last, stone dead, but a tell-tale trail of blood led on into some thick *tabin* bamboo showing that the animal first hit had gone on. I thoughtlessly ran on in the broad track left by the flying herd, till I was brought up by hearing a deep snort; looking up I discerned in the gloom the head of a bison thrown well up and staring wild eyed at me. I saw I was in for a charge and next second it came off, down

hill dashed the infuriated creature, I reserved the shots till the last moment, then letting off both barrels I sprang aside, my foot caught in a creeper and as I fell headlong my gun flew out of my hands. I felt my coat torn open and found myself lying down with the bison's chest on my out-stretched thigh. Now, Mr. Editor I have a fair chance for some tall writing about visions of all my past life floating before me; alas none came and my imagination is poor; all I remember thinking of was what a large eye the beast had got. Next second I saw a flash of white and my bull terrier had leapt across my body and closed with the bison, fixing her teeth firm in the beast's great india-rubber-like nose; the bison struggled to its feet and so you bet did I, my only idea being to get away. I felt very shaken and blundered away through the jungle till I suddenly felt myself falling and came down full length in a deep narrow nullah; I went down this for about 50 yards and coming to a pool, fetid and stinking, yet containing liquid which was I suppose 50 % water, anyway I lay down and drank, then feeling very revived I got out of the nullah and made my way back to my men. I was covered with blood and their concern on seeing my plight, hatless, gunless, covered with blood, dust, and a black grease off the bison, was great; however, on finding the blood wasn't mine they were relieved and we sat down to a council, as the dog shortly turned up wagging her tail, very blown but none the worse. I was for leaving the beast till the morning and coming with a spare rifle and then finishing the brute off. Not so the other two. With the Burman's insatiable desire for meat they wished to make sure and so it was decided that we should all go in and try and recover the Paradox and then have another shy that night, so in we went cautiously and I had luckily marked a tree with a Butea creeper nicely coiled round it, which I could go up; we had only just got into the jungle when we heard the charge coming. I went up my tree like a greased flash of lightning and the two Burmans each walked up a sapling; however, the bison had spotted one of the men and furiously charged his tree, it was only about 2 feet in girth with one fork near the top. I expected Maung Kyaw to be shot out like a stone from a sling but he hung on like a tick and worming himself into the fork, took off his paso and tied himself on. Then he commenced to abuse the bison, calling it the child of a female dog and making many disparaging remarks about its female relatives and the only treatment they were fit for; this seemed to annoy the bison for, every time Maung Kyaw started off on a compliment, the bison charged the tree. I tried to head the bison off with the dog but though the dog baited the brute finely it was no use, the animal meant to stick to the man up the tree; so entreating Maung Kyaw to give his inventive faculties and language full play I whistled the terrier off and then Maung Shwe and self

carefully crawled down our respective trees and got out in the open. Camp was 3 miles away, it was rapidly getting dark so I called out that we would go back and return with rifles, etc. Maung Kyaw, however, entreated me not to desert him as he was frightened of ghosts, so telling Maung Shwe to hurry to camp and explain matters to P. I promised to stay. I got as near Maung Kyaw as I could, got up a nice tree with the dog in my arms and sat down to wait. Every one of your readers has heard on a still night at home, when lying awake, the chairs creak as if some ghostly visitor was sitting down on them, well in that seemingly interminable wait I heard similar noises in the jungle. At first I thought it was a leopard on the dry leaves and called to Maung Kyaw but he said it was only "the jungle frightened," there was not a breath of wind so it must have been the rapid cooling of the air which caused these weird sounds. The bison kept a quiet and determined guard at the foot of Maung Kyaw's tree only moving to charge the tree if Maung Kyaw spoke. At last I heard the *touk, touk*, of the wooden elephant bell and my *haloo* was answered by a faint one in the distance; soon P. turned up with 5 elephants, spare rifles, whisky, soda, food, and blankets (it was about 9 o'clock), very much concerned as he understood I had been damaged; however the way I put down a whisky peg assured him there was nothing much the matter. Well, we couldn't do anything that night, it was pitch dark and the jungle too thick, whereas if the bison charged the elephants would have stampeded so, lighting a big fire we left a guard with rifles and went to camp to bed. I thus lost giving the beast the *coup de grace*, as, when we arrived on the spot next morning Maung Kyaw was down from his perch and the bison dead; one of the mahouts had crawled along the nullah and fired from a range of about 20 yards, missing clean, and near breaking his shoulder blade with the recoil; another sportsman then took the rifle and hit the beast on what the Burmans call the "pin," that is, what the beast would sit down on if it was two-legged, the second shot, he told me with great glee, hit the "baik" *anglice* belly, the bison now seemed to have had enough and started limping up the hill. Maung Kyaw hurriedly came down his tree, took the rifle, and pursuing the brute shot it dead.

I found I had hit with all three of my shots, the first had lodged between the coracoid and the humerus, splintering the former and chipping the latter, the other two had hit far back, one on each side of the back bone, how I managed to get home there, is beyond me. And here ends my yarn (I fear rather a lengthy one) of the most determined animal I have ever fired at, and out of which only my bull terrier and the bison came with credit; after all, the horns were not worth keeping but Maung Kyaw and his pals got a blow out of meat, so it's an ill wind, etc.

TAWKWE.

VI.—EXTRACTS NOTES AND QUERIES.

Athletic Sports at the Imperial Forest School.

The Annual Sports of the Imperial Forest School took place on the 30th and 31st October last, the former date being devoted to trial heats, while the second day was reserved for the finals and made the opportunity for a social function. There were eleven events on the card and the results were as follows.

Flat race, 100 yards, open to the whole School. The first heat was won by Puran Singh, 1st, and Munirulla Khan, 2nd. The second heat fell to A. R. Brown, 1st, and F. Gagliardi 2nd. The latter pair in the same order carried off the final in 11½th seconds.

Flat race, 100 yards, for native students. The three heats were won by D'Rozario, Kali Charan, and Prem Chand, the runners-up being Puran Singh, Mul Raj, and Krishnappa. Kali Charan proved the fastest of the lot, his time being 11½th secs. with D'Rozario very close up.

Hurdle race, 120 yards, over 10 flights. Open to the whole School. In the first heat, C. C. Chill and F. Gagliardi were first and second. The next heat was won by R. D. Hudson, followed by Puran Singh. The prizes fell in the order; Chill, Gagliardi, Puran Singh. Time 18½th secs.

Hurdle race, 120 yards, over 10 flights, for native students. The first heats were won by D'Rozario and Kali Charan, followed by Munirulla Khan and Krishnappa. The winner was Kali Charan, and his time was 20½th secs. D'Rozario was again a good second.

Flat race, half mile. Open to the whole School. This was a free gift for A. R. Brown, who was not pressed, and won easily in 2 min. 25 secs. looking as if he could have done a mile in very little more time. F. B. Powell was second, and Girdhari Lal third.

Throwing the cricket ball. Open to the whole School. Won by C. C. Chill with 91½ yards; E. Basten second. The prize reserved for native students fell to P. N. Mukerji, after whom came Musharaj Ali.

Long jump. Open to the whole School. This was won by C. C. Chill with 17 feet 6 inches. The prize reserved for native competitors went to D'Rozario with 15 feet 2 inches.

High jump. Open to the whole School. This was won by E. H. Johnstone, who cleared 5 feet 1 inch. Bakshish Singh took the prize for native students with 4 feet 9 inches.

Flat race, 100 yards, for School and Forest servants. This is always looked upon as a sporting event, and was won in fine style by Babu Upendranath Kanjilal's representative, Mantbar Sahai, Jowaru being second and Girdhari third.

Sack race, 80 yards, open to the whole School. This might have been taken for a jumping match between grasshoppers and was great fun. There were about 15 starters and they were nearly all well in it. C. C. Chill came in a good winner. It was a close thing between second and third. These competitors when got out of their sacks were seen to be Kali Charan and Puran; Singh. Numbers four and five came rolling in like animated barrels, and number four was quite under the impression that he had rolled into third place.

Tug of war. Seniors v. Juniors This gave rise to a long and determined pull. After many vicissitudes and immense excitement the Juniors proved the stronger team.

The prizes were very kindly given away by Mrs. Hutchinson of the 2nd P. W. O. Gurkhas, and the proceedings terminated with cheers for everybody, especially the ladies, whose dainty toilettes and pretty ways contributed so much to the success of the meeting.

A New Textile Plant.

Some years ago, an explorer in Asia discovered a plant of silken fibre, used by the Turkomans for the manufacture of withes and cord, and by the Canagues, for woven goods. This plant, known as *Apocynum venetum*, is a sort of bush with slender cylindrical branches, sometimes 6 feet high. It grows in Europe, Siberia, Asia Minor, the north of India, Manchuria and Japan but is not cultivated, and, up to the present has been used only in the natural state. The branches die yearly, and in the spring new shoots start horizontally from the roots. It flourishes best where the land is under water during a part of the year, notably in the neighbourhood of rivers that overflow at stated periods. Under favourable conditions the *Apocynum* develops quickly, and in a short time the branches form a thick growth, almost like a miniature wood. The best fibre is obtained by cutting the branches in midsummer, when the plant has obtained its full growth. The attention of the Russian Government was called to this plant in 1891. It is there known as the *Apocynum sibericum*, because it it was first seen in Siberia. It grows luxuriantly on the banks of the Amu-Darya, and the Ili, and the natives of the regions have used the fibre for many years for cord and fish nets. They value it not only for its great strength, but also because no care is required in its cultivation. In 1895 the Russian Government began to use it in the manufacture of bank notes, and since then the plant has been cultivated at Poltava. The results obtained thus far are considered excellent, and the time is doubtless near when the *Apocynum venetum* will take an important place in the textile market.—*Commercial Intelligence.*

The direct assimilation of Carbohydrates by plants.

Up to within very recent times a firm line of demarcation in the vegetable kingdom has been drawn between the higher or green plants which contain chlorophyll, and the lower or non-chlorophyll-containing plants. By means of their chlorophyll apparatus, the higher plants absorb from the sun's rays energy which enables them to decompose water and the carbon dioxide of the atmosphere into their elements, from which a fairly simple chemical substance is first constructed; and then, by a progressive series of reactions, the highly elaborate and complex materials, such as starch, gums, oils, tannins, and various sugars, which are easily identified as plant-constituents. The first product is usually held to be formic aldehyde, though it has not yet been identified in the plant itself as such. Many of the complex substances, however, have been artificially prepared from formic-aldehyde by the skill of the chemist in his laboratory, so that the indirect evidence is fairly conclusive, and the theory will probably be held good until actually disproved. The lower plants, however, being without chlorophyll, are obliged to make use of complex substances already elaborated. The fungi, for example, possess a destructive energy which enables them to break down for their own use, such substances as sugar, bread, wood, leather, and other organic materials upon which they are commonly found growing. These are thoroughly established views. Thus, in a recent *résumé* of the subject of plant assimilation, entitled, "The origin and formation of organic matter in plants,"¹ which was republished in the *Journal* of the Royal Agricultural Society as late as June last,² a careful and detailed account of this mode of carbon assimilation is set forth. Moreover, it is the only method which the writer considers it necessary to refer to, although he deals very fully with the latest work that has been done on the allied subject of the fixation and assimilation of atmospheric nitrogen by certain families of green plants.

Evidence is now gradually accumulating, however, that this is by no means the whole truth on the subject of carbon assimilation. Since the year 1886, when the work of Hellriegel and Willfarth and others demonstrated the extremely important part played by micro-organisms in the metabolism of leguminous plants, lines of investigation have been opened up that have shed much light on the formation of carbonaceous compounds. The final result towards which these experiments point is the possibility of green plants being able to assimilate, directly through their roots, food materials that already contain complex carbon-compounds. It is only possible here to indicate the links in the chain of argument.

Winogradsky noticed that a certain lower plant, *Clostridium Pasteurianum*, was able to fix nitrogen in direct proportion to the amount of sugar supplied to it in the nutrient media.³ This

1 Deherain. *Exp. Stat. Records*, Vol. 12, No. 10 U. S. Depart of Agric.

2 *Journ. Roy. Agric. Soc* III, Vol. X, part II, No. 38, p. 414.

3 Winogradsky. *Arch. Sci. Biol.*, 1895. 3, p. 297.

was also found to be partly true of some common moulds, such as *Aspergillus niger* and *Penicillium Glaucum*.⁴ Mazé found that micro-organisms from a leguminous root-nodule, grown on nutritive material prepared from an infusion of haricot bean, are able to fix nitrogen when 2 per cent. of sugar is added.⁵ Bouillhao has found that *Nostoc*, a green alga, in the presence of soil bacteria, fixes nitrogen in the absence of organic matter it is true, but the yield is increased four-fold when a dilute solution of glucose is supplied, and under these conditions the organism can even grow in the dark, and form chlorophyll.⁶ Up to this point it would seem that the fixation of nitrogen is clearly connected with the presence of a carbohydrate, either specially added or present in the tissues of an associated plant, or else, to remove the cause a step further, with the presence of organisms capable of manufacturing suitable carbohydrates. Acting on the suggestion that the vigorous assimilation of nitrogen by the bacteria of leguminous root-nodules, may be due to the carbohydrates present in the legume itself, Golding has carried out pot-experiments on the effect of supplying glucose to bean, lucerne, and clover plants, and finds that a marked increase in growth is produced thereby.⁷ Further, Laurent has shown that seedling plants, such as maize, can grow, increase in weight, and form starch in the sterile solutions and in the absence of carbonic anhydride when glucose is supplied to their roots.⁸ Finally, Mazé, again, working with sterile water cultures, shows that vetches can be grown in the dark, at the expense only of glucose supplied to their roots.⁹ It is true that the green plants employed in these experiments belong to botanical orders that most clearly exhibit the phenomenon of nitrogen fixation through the agency of associated bacteria. Whether plants not distinguished by this property can be made to assimilate carbohydrates directly is the subject of further experiments at the present time. Should this prove possible, then a practical issue, quite apart from the extreme theoretical value of the result, may be foreseen. Sugar and other carbohydrates, though prohibited by their cost for manurial purposes on an agricultural scale, might be valuable agents for a special purpose, such as, for instance, the production of fruit, flowers, and vegetables under glass and with a minimum of sunlight, at periods when they are usually obtained only with extreme difficulty.

There is also evidence in another direction that the chlorophyll theory does not explain all the facts of carbon assimilation and plant-energy. Thus, Green has published experiments from which he draws the conclusion that there exists in plants a power of absorbing and utilising the radiant energy of light, sometimes to a considerable extent without the presence of a chlorophyll apparatus.¹⁰—*Imperial Institute Journal*.

Purlewitsch. *Ber. deut. bot. Ges.* 13, p. 339.

Mazé. *Ann. Inst. Past.* Jan. 1897, p. 44.

Bouillhao. *Ann. Agron.* 1898, 24 p. 561.

Golding. *Journ. Soc. Chem. Ind.*, Vol. XVIII, p. 565.

Laurent. *Compt. Rend.* 1898 127 p. 786.

Mazé. *Compt. Rend.* 1899, 128, p. 185.

10 Green, *Proc. Roy. Soc.* 1897, 61, p. 25.

Recent sales of some unusual Indian and Colonial Drugs.

At the drug auctions held in London last month, several unusual consignments were offered for sale. Most of these were samples of Indian and colonial drugs which had found their way to the London market, and there was also a supply of ipecacuanha root from the East Indies. Particulars of the different articles are furnished by *The Chemist and Druggist* for June 24 (p. 1000).

First in importance is the arrival from Singapore of two bales of ipecacuanha, which there is little doubt came from Johore. At present we are entirely dependent upon South America for our supplies of this important drug, and for some time past there has been a considerable scarcity in the market, stated to be due to the fact that the natives of Brazil have, to a large extent, abandoned the collection of ipecacuanha root in favour of India rubber. However this may be, the last digging season, which ended in March, only yielded 180 bales of the drug, about a fourth of the average crop, and consequently there appeared every probability of increased scarcity before the next harvest in November. The supply of East Indian ipecacuanha, therefore, arrived at a very opportune moment, and in the present condition of affairs a constant supply from the same source would be most welcome. Attempts have previously been made to cultivate the plant, *Psychotria ipecacuanha*, in both India and Ceylon without success, but it appears to grow well in the Straits Settlements, where some years ago a plantation was established in Johore. In 1888 two packages of the root were received from Singapore; it was of excellent appearance, though slightly damaged, and yielded 1·4 per cent. of emetine. Last month, after an interval of eleven years, a further consignment of the same drug from the same locality made its appearance. It was a splendid specimen, clean and well annulated, and realised 12s. 10d. per lb. at the public auction. This compares very favourably with the recent prices of the Brazilian drug, and Mr. J. C. Umney finds that it contains 1·6 per cent. of emetine. There is no doubt that further supplies of this quality would find a ready market here, and the extended cultivation of the plant in the Straits Settlements appears to be worthy of attention.

The other drugs referred to above may be briefly noticed.

Under the name of "Gookhru" a bale of roundish five-cornered fruits, armed with formidable prickles, was offered for sale. These were the fruits of *Tribulus terrestris*, a low trailing plant, which is common throughout India, and belongs to the natural order *Zygophylleæ*. It is known as Gokbru or Ghókru, and the whole plant, but more particularly its fruits, which are always procurable in the native drug marts, are used medicinally throughout India. It is said to possess diuretic and tonic properties, but its chemical constituents are not known. According

to the authors of *Pharmacographia Indica* the fruits contain a body having alkaloidal properties, together with fat and a resin, to the last of which the aromatic odour and taste are probably due.

Another Indian drug was offered as "Bavachi," and consisted of the seeds of *Psoralea corylifolia*, a herbaceous weed belonging to the *Leguminosae*, and common throughout India. The seeds are ovate or reniform in shape, dark brown in colour, and possess an aromatic and bitter taste, due to the essential oil which they contain. The oil is used by the natives both internally and externally as a remedy for leprosy and other skin affections, and has been strongly recommended for the purpose by Dr. Kenny Lall Day.

Fourteen bags of bark shipped from Sydney were offered as "Sassafras," a name applied to various plants. The bark in question was probably derived from *Beilschmiedia obtusifolia*, a large handsome tree of Queensland and New South Wales, belonging to the *Laurineae*, and known as "Queensland sassafras." It is extremely fragrant and possesses aromatic and tonic properties. When dry it is said to yield 770 oz. of essential oil per ton, and also contains 7.5 per cent. of tannin similar to, or identical with, cinchona tannin. Another bale was offered as "Labrador Tea," and consisted of the leaves of *Ledum latifolium*, a small shrub belonging to the heaths, and found in swampy places in Canada and the Northern States. The leaves have an agreeable odour and taste, and are used by the Cree Indians, who name the plant "Maskoego," as tea.

Reference may be made, in conclusion, to a recent communication relating to the important drug, *Strophanthus*. Mr E. M. Holmes, Curator of the Pharmacæutical Society's Museum, refers in the *Pharmaceutic Journal* for July 8, to the difficulty of obtaining in commerce the pure seeds of *Strophanthus kombe*, which agree with the description and colour test of the *Pharmacopœia*. Commercial *strophanthus* frequently consists of a mixture of the seeds of various species, and is liable to considerable variation. It is pointed out that *S. kombe* is a native of East Africa, and has not yet been found in West Africa, any *strophanthus* seed imported from the West Coast is very unlikely to be the genuine article. Mr. Holmes has ascertained that even the best commercial *kombe* seeds consist of at least two, and probably three, species mixed together, and from specimens of the plants these have been identified as *S. emini*, *S. kombe* and *S. courmonti*. The variety which complies with the *Pharmacopœia* tests has been determined, and it is proposed in future to import these seeds in the pods, instead of loose, so as to obtain a seed of uniform character. All packages of this genuine *strophanthus* will be marked A. L. (.) L. "Mandala Brand," London, and it is hoped that by the use of a pure and uniform drug the somewhat uncertain action of the tincture made from the present seeds will be remedied.—*Imp. Inst. Jour.*

The Hill Forests of Western India.

The following description of some of Bombay forests is extracted from a lecture delivered by Mr. H. M. Birdwood, C.S.I., L.L.D., M.A., given at the "Greater Britain Exhibition" on the 4th of July, 1897; and printed in the Journal of the Society of Arts.

The particular area of which I spoke at the beginning of this paper is within easy reach of the City of Bombay. It includes hilly tracts of country on either side of the range of Western Ghâts, in the Dekhan and Konkan respectively, between the latitudes, roughly speaking, of Bombay and Satara. As compared with other forest areas elsewhere in the Presidency, it is by no means remarkable, so far as the production of valuable timber is concerned; but it is of interest as illustrating generally the methods of the Forest Department; and it is of special interest to the inhabitants of Bombay and many other cities in the plains, as it includes the two popular hill stations of Matheran and Mahableshwar, which owe much of their value as health resorts to their pleasant woods and abounding undergrowth of beautiful shrubs and flowering plants and ferns, which everywhere keep the ground cool, and the air sweet and fresh. Both in climate and splendour of wild woodland scenery they furnish an instructive contrast with those hills of the same tract which have suffered from the destruction of forests in the manner I have already described. An account of the forest flora of Matheran and Mahableshwar will apply generally to similarly preserved portions of the Western Ghâts and the adjoining regions; and, in the time that is left us, it will be sufficient perhaps if I deal only with the flora of these two hills. Their vegetation is not indeed identical. Dr. Theodore Cooke, formerly principal of the College of Science at Poona and an accomplished botanist, who always found his "pleasure in the pathless woods" whenever he could escape from college lectures, has estimated that, exclusive of grasses, about 140 flowering plants are found at Matheran which have not been seen at Mahableshwar, and 130 at Mahableshwar which have not been seen at Matheran. Some of the conditions which regulate the distribution of plants are not indeed equally operative at both places. Mahableshwar is about 70 miles nearer the equator than Matheran. The latter is an isolated hill rising from the plain of the Konkan, midway between the Ghâts and the sea; whereas Mahableshwar is further from the sea, and is to all intents, a part of the range of Ghâts. The highest point of Matheran is about 2,500 feet above the sea-level; whereas the Mahableshwar plateau is at a general elevation of 4,500 feet above the sea and rises at one point to 4,700 feet. These differing conditions are not without their effect. Some plants are found at Mahableshwar which will not thrive on the lower mountain top. Some Matheran plants, on the other hand, find

the higher levels of Mahableshwar beyond their range. I will give a few instances. The most casual observer is struck by the wonderful undergrowth of brake-fern at Mahableshwar and of the arrow-root plant—which in October and November blooms on almost every square yard of the jungle—and by the beautiful profusion of the *Osmunda* fern, mixed with clustering roses and willows, along the upper stream of the Yenna river. At Matheran the brake-fern is scarcely known. In a few years it will be extinct, if it is not already so; for being rare it has been the prey of thoughtless fern-hunters and cannot defy their onslaughts. It would be impossible for any number of fern-hunters to destroy it at Mahableshwar, and so it is left alone. Even if unmolested at Matheran, it drags on at best but a feeble existence. The site is too low for it, the lowest limit of its range in the latitude of Bombay being apparently a little more than 2,000 feet above the sea-level. The *Osmunda*, again, is not known at Matheran, nor is the Willow (*Salix tetrasperma*), nor the Arrowroot (*Hitchenia caulina*), though other allied plants of the order *Scitamineæ* are plentiful enough. On the other hand, there are some wellknown Matheran trees, such as the Kumbha (*Careya arborea*), the Malia or Indian ebony (*Diospyros assimilis*), and the Chandāra (*Macaranga Roxburghii*), which do not grow on the Mahableshwar plateau at all. But after full account is taken of all divergences, it is found that many plants are common to the two hills. Such a coincidence is favoured by the practical identity of their geological formation, and by the circumstance that there is no great difference in the range of their mean temperature at different seasons and in their rainfall. Both Mahableshwar and Matheran are huge masses of trap, capped by a thin layer of laterite. Both are within sight of the sea. Both are swept by the same dry winds in the cold weather, and by the same monsoon storms, and both enjoy the full benefit of the monsoon rains. The average mean temperature ranges at Mahableshwar from 63·3° Fahr. to 71·7°, and from 67·8° to 73·5° at Matheran. The average annual rainfall at Mahableshwar amounts to 281·4 inches, and at Matheran to 224·7 inches. Under such concordant influences, it is not surprising that a marked similarity should be apparent in the general outward forms of vegetation on the two hills, due to the frequent presence of the same characteristic plants on both. Everywhere at Mahableshwar, as at Matheran, we find the Myrtle tribe represented by endless woods of the beautiful Jambul tree (*Eugenia Jambulana*) the Melastomas by the Anjan or Ironwood (*Memeeylon edule*), the Laurels by the Pisa (*Litswa Stocksii*), and the Madder tribe by the thorny Gela (*Randia dumetorum*, a small tree, generally a shrub, with numerous stiff branches, armed with spines, and large fragrant white flowers, which turn yellow before they fade. There is the same undergrowth of shrubs and herbaceous

ous plants, the natural orders of *Leguminosæ*, *Acanthaceæ*, and *Compositæ*, being specially and numerously represented. There are many showy climbers, trailers, and creepers, and Orchids and *Dendrobiums* common to both hills; while everywhere the little silver fern covers with equal impartiality every sheltered bank and rock. Some years ago, before leaving India, I prepared for the Bombay Natural History Society's Journal, with the aid of several competent botanists, a catalogue of the flora of Matheran and Mahableshwar. I cannot pretend that it is a complete list, for the simple reason that during the four rainy months of the year, when most herbaceous plants are at their best, the hills, are practically inaccessible to Europeans; but in addition to the hill flora it includes some of the more conspicuous plants on the higher levels of the road from Poona to Mahableshwar; and the list of forest trees, which are conspicuous at all times, may perhaps be accepted as complete. It may interest you to know that of the 733 names included in the catalogue, about 125 are the names of trees or sub-trees, as distinguished from shrubs, creepers, grasses, ferns, and undergrowth generally. Of the trees probably not more than ten species have been introduced, and about 115 species are probably indigenous. They constitute but a small portion of the indigenous trees found throughout India, the number of which exceeds 2,000 species, but they give some idea of the diversity of forest vegetation in the limited area under consideration, if we bear in mind that the number of species of indigenous trees in Great Britain is only forty.*

The trees which have been distinctly introduced are the Peach, which is cultivated at the hill station of Panchgani, near Mahableshwar; the Stringy Bark (*Eucalyptus obliqua*), which does not take kindly to Mahableshwar, the rainfall there being evidently too heavy for it, but does better at Panchgani,—which at a distance of only ten miles from Mahableshwar, has a much lower rainfall—though not nearly so well as on the Nilgiri Hills; the *Chinchona succirubra*, which again has not been a success, as on the Nilgiri Hills and elsewhere; the Cassowary tree, or Beefwood (*Casuarina equisetifolia*), which has been extensively planted at Panchgani, but much prefers the lower lands nearer the sea, and especially the sandy beaches of the Konkan coast; the Oak (*Quercus obur*), of which, however, there are very few well grown trees; and the Mulberry (*Morus alba*) which was probably brought from China.

Among the more important or more conspicuous trees which may be regarded as indigenous are two species of *Garcinia*—the wild Mangosteen (*Garcinia indica*) and the Gamboja tree *Garcinia ovalifolia*; and two species of *Sterculia*—the *Sterculia urens*, from the wood of which native guitars are made and the

* Lieut.—Col. Bailey on "Forestry in India," *The Scottish Geographical Magazine* for 1897, p. 572.

Uolder (*Sterculia guttata*), conspicuous by its large, peach-shaped fruit, covered with scarlet down; the Silk-cotton tree (*Bombax malabaricum*), which attains a great size, and is a tree of strange beauty when in full bloom, with its large, showy, rose-red flowers; the Kasu (*Flacocarpus oblongus*) with leaves turning red in autumn, and clusters of flowers with white-fringe petals and reddish-brown sepals; the Frankincense tree (*Boswellia serrata*) which is plentiful on the Ghat road between Poona and Mahableshwar; and another balsamiferous tree, the *Canarium strictum*—yielding a gum, burnt as incense by the hill people at their religious services, and much sought after on account of the rarity of the tree, of which I have found only one specimen at Matheran, to my lasting wonder at its presence there, in a thick wood, far from its congeners, and hemmed in by countless aliens; the *Garuga pinnata* (belonging also to the same natural order *Burseraceae*), the bark of which is used in tanning; the Indian Satin-wood (*Chloroxylon Swietenii*), an excellent wood for cabinet work of the better kind; the Indian Red-wood or Bastard Cedar (*Soyimida febrifuga*), the bitter bark of which is used as a substitute for cinchona bark; two species of the Jujube tree (*Zizyphus*); the Koe-himb tree (*Scheichera trijuqa*) on the young branches of which lac is produced in many parts of India; the well-known Mango tree (*Mangifera indica*) which is found wild on many hills, though sometimes said to have been introduced by the Portuguese monks from Brazil; the "Flame of the Forest" (*Butea frondosa*), which has given its name,—Palas—in the vernacular,—to the memorable plain of Palasi, commonly known as Plassey; the Black-wood tree (*Dalbergia latifolia*), of which is made the elaborately-carved furniture, which at one time was much prized in Bombay, the beautiful Indian laburnum (*Cassia fistula*); the *Acacia Suma*, from the wood of which Catechu is manufactured; and yet another beautiful representative of the order *Leguminosae*, the Laeli (*Albizia stipulata*), a very conspicuous tree at Matheran, with clean stem and spreading branches, finely pinnate leaves, and large acacia-like flowers, with numerous, white, lilac-tipped stamens; the Ain (*Verninalia tomentosa*), a valuable timber tree; the Myrobolam tree (*Terminalia Chebula*), which is found in great abundance on Mahableshtar, the fruit—the Chebulic Myrobolam of commerce—being largely exported, coming indeed, for the whole of India, third on the list of exports of forest produce, as regards valuation, and second, as regards quantity; the Jambul tree (*Eugenia Jambolana*), already referred to, which may be regarded as the most characteristic tree of both Matheran and Mahableshtar, impressing as it does, most effectually, its grace of form and beauty of colour on all the landscape and shading the ground everywhere with a cool canopy of sweet-scented leaves; another tree, also of the Myrtle order (*Careya arborea*), which has been already referred to; the Ironwood (*Memecylon edule*), which has also been referred to and is also a characteristic tree of both hills, with its dark shining

leaves, like the leaves of the Camellia; the Benteak tree (*Lagerstroemia parviflora*), which yields a wood of excellent grain for the cabinet-maker; the Kánta Kumbal (*Sideroxylon tomentosum*), a tough, hard-grained tree, as its name implies; the *Bessia latifolia* or Mowrah tree, from which Mowrah liquor is made in other parts of India; and yet a third tree of the Sapodilla order, the Bokul (*Mimusops Elengi*), with dark green foliage and honey-scented flowers; the *Diospyros assimilis*, one of the Indian ebonies; the Kaola (*Symplocos Beddomei*), with blossoms scented like the hawthorn and blue berries; the wild Olive (*Olea dioica*); the Wáras (*Heterophragma Roxburghii*) a tall tree of the Bignonia or Trumpet-Flower Order, with grey pinnate leaves and clusters of showy white bell-shaped flowers; the Teak tree (*Tectona grandis*), the most important of all the forest trees; the Shewan (*Gmelina arborea*), the pale yellow, close-grained wood of which is used for planking, furniture, the panels of doors, &c.; the wild Nutmeg (*Myristica attenuata*); and 15 species of the Laurel order, all notable and some of them very beautiful trees, the two most notable being the *Litsæa Stocksii*, already referred to, a shapely laurel rising to a height of 20 feet or more, and generally assuming a pyramidal tapering form, and displaying whorls of pale bluish leaves—a very characteristic tree of both hills—and a species of Cinnamon (*Cinnamomum Tamala*), of which I have found only four specimens, all at Matheran, a striking and handsome tree, though of no great size, with tufts, when first bursting into leaf, of small, pink, transparent leaves, which afterwards lengthen and become pointed at both ends, and have marked ribs or nerves, and are dark and shining above, and when dried turn to a rich brown, and yield a spicy scent when crushed. These, with several species of trees of the Spurgewort order (*Euphorbiaceæ*), which is well represented on both hills, and includes the *Macaranga Roxburghii*, already referred to, and readily recognised by its large ovate and peltate leaves, and the Hasúna (*Bridelia retusa*), a good timber tree, and of the genus *Ficus*, which includes the well-known Banyan tree, the sacred Pipal, the Sycamore tree of the Bible, and other Figs, not so well known; the stately and fine foliaged Jack tree (*Artocarpus integrifolia*), with its enormous fruit, allied to the Figs, the Willow (*Salix tetrasperma*), and the Fish tail palm (*Caryota urens*)—the only palm included in my catalogue—make up a fairly full list of the more conspicuous of the forest trees on the two hills.

I wish I could convey to you something more than a dim conception of the beauty and perennial charm of these Indian woods. But that is beyond my power. It will be enough for me, and I shall be quite satisfied, if, by my narrative, imperfect and meagre though it be, I shall have helped you in any degree to appreciate the value of the great work done by those who have preserved and improved the forest tracts of British India to the lasting benefit of the State and the people.

VII. TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

OCTOBER 4TH, 1899

EAST INDIAN TEAK —The deliveries for the first three-quarters of the year amount to 14,142 loads against a delivery of ten loads more than this in the same period of 1898. For September this year the figures are 1,248 loads, and in September, 1898, they were 1,545 loads. There is no change to record in London prices, but the market generally is very firm and all floating cargoes near at hand are snapped up at high rates mostly for Continental Governments. There is still some feeling of uncertainty as to whether present prices are to hold through another year, based apparently on theories that they have lasted about long enough and leaving out of account the increased and sustained demand.

ROSEWOOD.—**EAST INDIA** —Shipments not being too heavy sales are readily made at good prices.

SATINWOOD.—**EAST INDIA.**—Stock is heavy, demand quiet and sales slow.

EBONY.—**EAST INDIA.**—Is rarely asked for.

PRICE CURRENT.

Indian Teak, per load	...	£11 10s.	to £16 10s.
Rosewood	„ ton	£9	to £11
Satinwood	„ foot(superficial)	5d.	to 12d.
Ebony	„ ton	£6	to £8

Denny, Mott and Dickson's wood Market Report.

LONDON, 2ND OCTOBER, 1899.

TEAK.—The landings in the London Docks last month consisted of 775 loads of logs and 461 loads of planks, as against 689 loads of logs and planks for the corresponding month of last year.

The deliveries from the Docks into consumption were 1,022 loads of logs and 269 loads of planks, as against 1,403 loads of logs and planks in September, 1898. The stocks in the London Docks at date analyse as follows:—

5,718	loads of logs, as against	8,636	loads at the same date last year.		
2,749	„ planks	„	2,478	„	„
8	„ blocks	„	33	„	„
<hr/>					
8,470	loads	„	12,147	loads.	„
<hr/>					

The figures for the past nine months show a *decrease* of fully 23½ per cent. in the landings at the London Docks, and an *increase* of 1½ per cent. in the deliveries, in comparison with the landings and deliveries for the same period of last year; the logs and planks for the respective periods showing as follows :—

9,625 Loads landed at London Docks from 1st January to 30th September, 1899, against 12,589 Loads for the same period in 1898.

14,182 Loads delivered from the London Docks from 1st January to 30th September, 1899, as against 13,936 Loads for the same period last year.

The market during the last three months has not been so active as during the first six months of the year, owing, partially, to the comparatively small stock, which at date is fully 80 per cent. less than the very moderate stock in hand on 30th September, 1898; partially to the increased cost of timber at the Shipping Ports; and partially to the quarter just ended being the holiday period of the year. Against the merchants' protest on this side that the largely increased cost of teak must eventually tell on its use here, shippers claim that the augmented demand in the East renders them indifferent to the European demand, and so far as this is the case, so far must the shippers' demands be complied with; but any decrease in the volume of the world's trade will affect the East as well as Europe, and teak shippers sooner or later may have to recognize that it is bad policy to alienate consumers on this side by endeavouring to force unreasonable prices on the European market. Their present pretensions cannot yet be deemed unreasonable, although the volume of wholesale cargo buying has been greatly reduced thereby, and a "hand-to-mouth" business is the consequence; this means paying dock and rent charges which would be better in the wholesale consumers' pockets than in those of the Dock Companies'.

Business during the third quarter of the year certainly lacked animation, owing to the holiday season; but a steady and well-sustained consumption underlay this apparent lack of briskness, and prices have held very firm in nearly all descriptions of timber. The concluding quarter of the year generally develops a good demand, especially in Hardwoods, and 1899 should close satisfactorily to all holders of stocks, subject to the trouble in South Africa not developing a general depression, which would not only affect the demand but cause a restriction of the easy financial facilities to which speculative buyers have become accustomed during the last two or three years of increasing confidence in the general prosperity of trade.

MARKET RATES OF PRODUCE.

Tropical Agriculturist.

OCTOBER 1ST, 1899

Cardamoms	per lb.	2s. 6d.	to	2s. 9d.
Croton seeds	„ cwt.	40s.	to	55s.
Cutoh	„ „	28s.	to	35s.
Gum Arabic, Madras	„ „	27s. 6d.	to	35s.
„ Kino	„ „	24s.	to	47s. 6d.
India rubber, Assam	„ lb.	2s. 10½d.	to	3s. 2d.
„ Burma	„ „	2s. 9d.	to	3s. 2d.
Myrabolams, Madras	„ cwt.	5s. 6d.	to	6s.
„ Bombay	„ „	4s. 9d.	to	9s. 6d.
„ Jubbulpur	„ „	4s. 8d.	to	7s.
„ Bengal	„ „	4s. 6d.	to	6s.
Nux Vomica	„ „	7s.	to	10s.
Oil, Lemongrass	„ lb.	2½d.	to	2½d.
Sandalwood, Logs	„ ton	£20	to	£50.
„ Chips	„ „	£4	to	£8.
Sapanwood	„ „	£4	to	£5.
Seedlac	„ cwt.	55s.	to	60s.
Tamarinds, Calcutta	„ „	15s.	to	16s.
„ Madras	„ „	7s. 6d	to	8s. 6d.

THE INDIAN FORESTER.

Vol. XXV.]

December, 1899.

[No. 12.

Forestry in Madagascar.

Aspect and resources of the forests.—Speaking roughly, the area of the forests in this French colony appears to be about 10 or 12 million hectares (hectare = $2\frac{1}{2}$ acres), but the western and southern portions of the island are so little known that this estimate makes no claim to precision. The forest varies in character according to localities and may be classed generally into three types, viz., the coast forests, the inland forests up to 700 or 800 metres of altitude, and the upland forests, from 800 to 1,800 metres. It is interesting to note that altitude makes little difference, the forests in the north being much the same as those in the south, whereas in Europe, and even in the smaller area of France itself, the northern forests differ widely from those in the south.

Coast Forests.—The forests in the vicinity of the sea, at least for the east coast, are all much alike, with this difference that in the north the more valuable species are more plentifully distributed than in the south. These forests are not usually of large area, and are divided either by swamps and lagoons or by cleared lands. They are characterised by a special type of trees, such as the *nanirorofo* or copal, the *hintsina* or *Hazelia bijuga*, the *Terminalia catapa* almond, two *Ficus*, other trees called *varongy*, *voapaka*, *nato*, *nanto*, *fantsikahitra*, *fotoro*, *filao*, and among timbers specially suited for cabinet work, ebonies, *palissandres*, rosewood, and a species of mahogany called in the west *mahibo*. Among secondary species are found a rubber tree, the *barabanja* or *hazondrano*, *Vahea* rubber climbers, *Landolphia* or *Hancornia*, edible fruits like the *voantaka* and lime, also palms and *pandanus*. These coast forests are valuable because they contain species that cannot be grown elsewhere, and also because they form a protection against strong winds from the open sea which might otherwise prove injurious to agriculture.

Inland or median forests.—The forests of moderate elevation are by far the most important in the island, whether on account of their extent or on account of their richness. In some parts, for instance near the Bay of Antongil, they come almost to the coast.

At similar elevations, the forests of the north-west resemble those of the east, still, from about the 16th parallel, those of the west differ appreciably in appearance and composition from those on the east. In the latter, the Filices are the more plentiful, in the former the Leguminosæ preponderate. Hence results a considerable difference in general appearance. In the east, the broad-leaved species are frequently evergreen, while in the west many are deciduous. It is estimated that these median forests contain about 1,200 woody species, of which 800 attain a height of 8 to 30 or 40 metres. Among those of commercial importance as timber or cabinet woods the following families are represented.

Rubiaceæ—*tambaribarisa*, *sohisy* or *sondindranto jansikahitra*.

Saxifragæ—*lalona*, *hazomena*.

Leguminosæ—*voamboana* and other rosewoods, *harahara* one of the hardest and finest coloured woods, *volomborona*.

Malvaceæ—*baobab* or *boutono*, *varo*.

Guttiferæ—*ramy*, one of the most remarkable trees of the family, *joraha*, and *intonina*.

Obtlanaceæ—*lotona* and *anjanajana*.

Taccaceæ—*torolo*.

Coniferæ—*hatrata*, the only representative of the family.

Urticaceæ—*fanidy* and three figs.

Euphorbiaceæ—*tapia*, *voapaka*.

Proteaceæ—*vivaona*.

Monimiaceæ—*ambora*, several varieties, some of which resemble sandalwood.

Loganiaceæ—*lambinana* and *valanirana*.

Ebenaceæ—several species of *Diospyros* (black, green, or striped ebony) culled *hazomainty*.

Rhizophoraceæ—*haz mamy*.

Liliaceæ—*vanana*, *hazondrano*.

Sapotaceæ—*nato*, *nanto*.

Lauraceæ—*varongy*, 2 or 3 species.

Compositaceæ—*merana*.

Myrtaceæ—*rotra*.

Terebinthaceæ—*mahibo* or apple-mahogany.

Melastomaceæ—*bongo*.

Bignoniaceæ—*hitsikitsika*.

High level forests.—The forests at high altitudes appear to cover about a fourth of the wooded area of the island, or some 3,000,000 hectares. Where they adjoin the median forests the composition is similar, but gradually alters as the elevation

increases. Cabinet woods are only represented by a few palissandres and some other species not yet fully accepted in commerce.

(Note. *Palissandre* is generally translated rosewood, and is so found in dictionaries. Here, however, some distinction is made.)

There is no more mahogany, no ebony, no rosewood. These valuable species hardly surmount 600 metres, their favourite altitude being 300 to 400 metres. Nevertheless, numerous fine specimens are found in these forests when they are near the sea, both east and west, but specially in the north. These elevated forests are difficult of access, the soil being shallow and steep. They never have that appearance of neatness which is found in those of the lower regions, some of which almost call to mind European forests where great climbers are unknown. Here, on the contrary, is found an inextricable tangle of lianas, climbers of all kinds, bushes, climbing bamboos, and other things which vastly impede progress. Consequently these forests are but imperfectly known, for the more important work at lower levels is enough for the present to claim all the energies of the staff. Nevertheless, it is ascertained that they contain many valuable species, for instance, *lalona*, *hazomainty*, several *voamboana*, *anato*, *harahara*, *hazovola*, *ambora*, *voanana*, *rivoana*, *varongy*, *famelona*, valued for its elasticity, *hazondrano*, almost as good, *mokarano*, *paka*, *fanidy*, *valarinana*.

All this valuable property has been of late years considerably trenched upon, both by the natives and by foreigners who obtained from the Malagasy government concessions over vast areas which they abused to the benefit of their own pockets and utterly regardless of consequences. This state of things is now stopped by regulations and a Forest Service, drawn up and established by General Gallieni.

Organisation of the Forest Service.—Considering the inadequacy of the budget and the present impossibility of surveying and superintending the whole of the forests properly by means of a full staff, the functions of the forest service are limited to advising the Heads of Provinces, with a view to the preservation and proper working of the forest property. It appears that M. Cornet, Inspecteur Adjoint and Chief of the 1896 mission, has departed, and that the Service now consists of M. Girod-Genet, Inspecteur Adjoint, Chef de Service, two resident gardes generaux at Majunga and Antananarivo, a Brigadier and two gardes at Antananarivo. Another garde general and two more gardes are probably by this time appointed. A school for native gardes is also in course of organisation. Circulars have been issued to Heads of Provinces warning them against alienating valuable forest lands, instructing them in the best means of preserving the forests and assuring their regeneration, enjoining them to prevent damage by cattle, and to keep out fires. Natives are not allowed to scatter about

the forests where they like, but are to be limited to fixed settlements or villages. These steps are stated to be already beneficial.

Reboisement.—Protection alone will not suffice to bring the forests into the highest possible state of efficiency, for there are, especially in the central regions, immense areas where wood is a missing necessity, not only for trade but also for agriculture and the general prosperity of the people, who can obtain neither timber nor firewood at present. The reclothing of Imerina and Betsileo districts has, therefore, been decided on, and for this purpose nurseries have been started at Antananarivo and in the central provinces. The Antananarivo nursery, adjoining the agronomic station of Nahanisana, is more especially for cultural experiments, with a view to the acclimatisation of useful exotics and to the acquisition of a practical working knowledge of the native species. It possesses already 1,211,650 young plants of various trees, among others *Melia azedarach*, which appears to be the most promising species for the rapid creation of a canopy, several varieties of *filao*s (*Casuarina tenuissima* and *equisetifolia*), *Acacia Lebbek* or *bois noir*, *Acacia heterophylla*, which has given good results, *Eucalyptus robusta* and *botryoides*, *Manihot Glazehovii*, sycamore, Norway pine, chestnut, *Quercus suber* (cork oak) and *robur* and *niaouli*. The provincial nurseries, about eight of them, contain about 4,000,000 plants. Outside Antananarivo an area of 537 hectares has been planted up with 400,000 plants.

Regulations.—The exploitation of forest produce has been regulated by a decree of 3rd July 1897, which permits the grant of concessions under proper control, since it is not yet possible to introduce a system of annual fellings such as obtains in civilised countries. The mode of exploitation is laid down, and the royalty payable by contractors is fixed at 10 centimes per hectare annually up to 20,000 hectares, and 15 centimes per hectare per year over that area. This seems little enough. The natives are allowed to collect minor produce such as rubber, wax, gum, saffron, &c, and to take, for a trifling payment, such wood as they may require for household use, within prescribed areas. The villages are held responsible for frauds or abuses, and are, therefore, less well off than the natives of certain parts of India, where there is every privilege and no kind of responsibility.

Prices.—The values of different articles of forest produce may be interesting. They are as follows :—

1. At Antananarivo :—

1st quality timber,	120 to 130 francs the metre cube	(= 34½ c. ft.)
2nd do	105 to 110 do do	
Deadwood	90 to 100 do do	
Charcoal, Native	10 to 14 fr. the 100 kilogrammes	(kilo = 2½ lbs.)
Do French-made,	28 fr. do do	

2. At small coast ports, like Vohemar, N'Gontsy, &c.

Rosewood logs, per ton, about	25	fr.
Ebony do do	30	fr.
Palissandre do do	14	fr.
Mahogany do do	14	fr.
Planks per sq. metre do	90	centimes.
Scantling per running metre	3	fr. 50 c. to 13 fr. 50 c.
Shingles (bardeaux) per 100	20	fr.
Rubber, per kilogramme	3	fr. 50 c. to 4 fr. 50 c.
Animal wax do	1	fr. 75 c.
Copal do	1	fr. 40 c.
Rafia fibre do	35	c.

3. At the larger ports, such as Diego Suarez, Tamatave, Majunga, the above prices must be increased by about 30 to 40 fr. per ton to cover cost of freight and transhipment, plus agent's profits.

Introduction of Ceara rubber (Manihot Glazehovii) &c.—The coast regions, possessing a hot and moist climate, lend themselves admirably to the culture of tropical species such as cocoa, coffee, tea, cloves, vanilla, cocoanut, pepper, sugarcane, and rubbers. The climate is not the same everywhere. In Imerina and Betsileo the year is divided between two seasons, dry and cold from May to October, hot and rainy from November to April. But on the east coast between Cape Manambato north of Vohemar and Fort Dauphin these seasons mean merely greater or less heat, with more or less rain. The coast is always hot and moist, with luxuriant vegetation and running streams. Most of the plantations are in the less unhealthy districts, to wit, Sumbavaha and Antalaha in the north, Vatomandry, Mahanoro, and Mananjary in the centre of the east coast. Ceara rubber was introduced in 1888, near Fort Dauphin, and some of the plants are now 1 metre in girth and 24 ft high. Some plants have even seeded at 18 months old, and gave good rubber as an experiment, though plants are not usually tapped till they are 5 or 6 years old. Ceara rubber appears to prefer a dry and rocky soil. It does not prosper in rich moist loam, though the soil into which the young plants are potted out is fairly moist and good. In rich damp soil the trees gradually die off, from no apparent sickness, but the roots form large tubers like those of manioc, and appear to cease their functions. It is expected that the Ceara rubber, cotton, cocoanut, &c., will find a quite congenial home on the west coast, since it has a dry season which will enable them to resist the cryptogamic diseases to which they are liable when grown under continual moisture.

Report of General Gallieni, Governor of Madagascar.
(Abridged from the *Revue des Eaux et Forêts*)

III.—OFFICIAL PAPERS & INTELLIGENCE.

The spread of Loranthus in the Konkan.*Introduction.*

1. I was first induced to study the spread of Loranthus by reading an interesting paper on the subject in the January (1896) number of the "Indian Forester," Volume XXII, by Mr. H. C. Ashworth, which was taken from the August number of the "Victorian Naturalist." Mr. Ashworth had read this paper before the Fields Naturalists Club of Victoria, and Mr. Clifford forwarded it to the "Forester" with his remarks, hoping that a perusal of it would stimulate interest in the subject in India. In a foot-note to the paper the Editor, Mr. Gamble, added: "The subject of the dispersal of the seeds of the many Indian species of Viscum and Loranthus is one of great interest, and we recommend its investigation to our readers. The genus *Dicaeum* is rare in India, occurring only in Assam and Burmah, so that other birds are concerned in the dispersal." I commenced studying the subject when I came to Thána in 1897, where the *Loranthus longiflorus* was observed to be very prevalent. I did my best during that year to ascertain what bird assisted in the distribution of its seed, but was never able to obtain a specimen. An enterprising Forest Guard, however, brought me one and assured me that this was the culprit who spread the seed, and he related that the process was that the bird ate the viscid coating of the seed and, in order to disengage his beak from it, rubbed the former on a branch to which the seed became attached. The explanation seemed reasonable and very probable, and it was confirmed subsequently by some of the Thána wild tribesmen whom I consulted, and also corroborated by the investigations of Mr. Keeble, who, in a paper contributed to the Transactions of the Linnaean Society (copied into the "Indian Forester," Volume XXIII, page 64), wrote (regarding the Singhalese species): "When the fruit is ripe the bird eats the succulent portion only, wiping out the seeds with its beak on a branch of the tree, to which they thus become attached by their viscid coating. If swallowed, the seeds are found to be digested and destroyed." During the greater part of 1898 I was absent from the Thána District, but in the latter part of that year my investigations were recommenced, and I was rewarded early in 1899 by personally seeing the bird, previously shown to me by the Forest Guard, feeding on the *Loranthus longiflorus*. I watched the bird, and the following is the result of my observations. My conclusions, as will be seen, are entirely opposed to those drawn by Mr. Keeble, and support Mr. Ashworth in nearly every particular.

Loranthus longiflorus on what trees found.

2. *Loranthus longiflorus* is a very common parasite on Teak (*Tectona grandis*) and Mango (*Mangifera indica*), especially in the South Thána Forest Division. Outside forests near villages it is most abundant on Mango, and inside forests on Teak. It is never found, as far as my observation goes, growing on Ain (*Terminalia tomentosa*), Dhowra (*Angogeisus latifolia*), Hed (*Adina cordifolia*), Kalam (*Stephegyne parviflora*), &c.* It is abundant in the drier parts of the district away from the sea. Nearer the coast, where the climate is milder and at altitudes of about 1,500 to 2,000 feet inland, the mistletoe parasite (*Viscum articulatum*) oftener exists.† Another species, *Loranthus scurrula*, also grows in the forests, but chiefly on *Bibla* (*Pterocarpus marsupium*) with rusty-coloured flowers.

Pollination of flowers.

3. *Loranthus longiflorus* bears white and red tubular blossoms, which commence to appear in December.‡ The species is ornithophilous and while in flower the bird most effective in its pollination is the *Arachnechthra asiatica*, the purple honey-sucker with a long-curved bill and grey-brown plumage. The full plumage of the male is metallic purple in colour with flame-coloured tufts at the base of the wings.**

In February the fruit commences to ripen. It is red-coloured, oblong in shape, and from $\frac{1}{4}$ " to $\frac{1}{2}$ " long.

Distribution of Seeds.

4. The seed is distributed by *Dicaeum erythrorhyncus*, a small bird about the size of a common Tailor bird, with grey-brown plumage and a light flesh-coloured short bill. The female and male are very much alike.‡

Method of distribution and characteristics of distributor.

The *Dicaeum erythrorhyncus* sits about from tree to tree chirping a while and plucking the *Loranthus* berries. He holds the fruit broadside in his beak, quickly jerks it round, bringing the blunt end towards his mouth, presses the pointed end with his bill till the seed is squeezed from the epicarp into his mouth. He swallows the seed whole, leaving the epicarp in his bill, and

* It is found in Sálsette on *Dalbergia latifolia*.

† In the neighbourhood of Thána both *Viscum* and *Loranthus* are prevalent.

‡ I have observed the parasite in flower in Sálsette in April-May and also in Murbád. General flowering, however, takes place in December-January.

** Mr. Finn, of the Calcutta Museum, very kindly identified these specimens for me.

‡ Mr. Finn also identified these specimens for me.

he then twists the latter about till all the viscid coating inside is extracted, when it is dropped. The whole operation does not last more than about 30 seconds. He never seems to use his claws to hold the seed at any time, nor does he appear to use them for any purpose, judging by the way he once behaved when a seed on one occasion stuck to his body. Instead of using his claws to work it off, as he might have done, he endeavoured to reach it with his bill, and this he failed to do until, at last, the seed had to be removed for him. A comparatively short space of time is required for him to pass the seed. In 8 or 12 minutes from the time of eating he voids it whole: in the majority of instances, without any excrement.

On one occasion I watched him for $\frac{3}{4}$ ths of an hour and in that time he ate and voided 9 seeds; on another occasion 2 in seven minutes. Two or three seeds generally are eaten in succession and voided all together, and there is attached to the cluster of seeds a long film-like substance which helps to make the seeds catch on to the branch when dropped and get glued there. Some discomfort seems to be felt in voiding, and evidently it is not a very easy operation judging by the way the bird behaves, for he jumps up and down and shakes himself vigorously till he has shed it. He works himself up and down in such a manner as to bring his posterior close up to the branch on which he is seated, so that on the thinnest branch of a tree the seed can easily become attached. The seed seems more sticky on emerging from the bird than before entering the mouth, and gets glued to whatever object it meets with. The long film attached to it evidently is a provision of nature to diminish the chances of the seed falling to the ground as it otherwise might do.

The bird also eats the fruit of the *Ficus glomerata*, as I observed, but this is indulged in more apparently when *Loranthus* is out of season.

As far as can be judged, it is not the seed that he seems to cure for in the case of *Loranthus*, but the viscid coating around it. I dare say if the latter could be extracted without swallowing the seed this would be done, but the difficulty seems to be when the fruit is in his bill for all the viscid coating to be extracted from the seed without any waste. He gulps down the seed therefore and sucks away at the epicarp.

Loranthus fruit is also eaten by the common grey squirrel. I was under a Mango tree on one occasion looking out for the *Dicaeum erythrorhyncus*, when I observed the squirrel on top of the tree eating the fruit.

The seed in this case was not swallowed; for while standing under the tree, the fruit, with the epicarp slightly damaged fell in quick succession on the ground, most of the viscid coating having been sucked out. There were no birds nor any other animal on the tree at the time, which was a small young Mango.

It is probable that other birds pluck the *Loranthus longiflorus* fruit and suck the viscid coating of the seed (children in the Thána District are very fond of this), but none could be found that swallowed the seed whole. The *Dicaeum erythrorhynchos* seems to be the only bird, at any rate in this part of the Konkan, that does this, and he is the distributor of the seed by eating the fruit on one tree and voiding the seed on another, and it is by voiding especially that the latter gets attached to the branches. Squirrels do not remove the epicarp from the seed, and although a seed now and then in falling may stick in a tree, still no spread of the parasite on other trees would take place by such agency.

I have never met with such a restless bird as the *Dicaeum erythrorhynchos*. For several hours he is jumping about and feeding. In five hours he ate and voided 50 seeds, not including the edible portion of *Ficus glomerata* fruit, which he also devoured. I need scarcely explain that my observations were over a bird in captivity; and I had him under observation for 3 days: suddenly on the third day he was found to have flown from his cage. How and when he departed I never could ascertain, but, perhaps, it is as well he regained his liberty, for he could not have been taken about conveniently in the district and, moreover, all the information about him I needed had been obtained. But I first detected him as being a voider and distributor of *Loranthus longiflorus* seed while watching him on trees and not while in captivity. He was, as I have previously stated, pointed out to me as being the culprit; but I never satisfied myself that he swallowed the seed and voided it, till on one occasion I brought him down with No. 10 shot. He was alive and quite vigorous and pugnacious. I killed a second and, in preparing him for despatch to the Calcutta Museum, found two seeds just swallowed inside him. Before I put the first bird out of his misery he tried to void a seed and in this state I despatched the specimen to Mr. Finn, of the Calcutta Museum, who wrote: "You have certainly definitely settled now that the bird feeds on *Loranthus*." It is perhaps as well to mention that the people about the district do not believe the bird drinks water. It is thought that there is a sufficient quantity of liquid in the viscid coating of the *Loranthus* seed to quench his thirst. For two days in the cage he did without water, because none was placed in it. On the third day, however, some was placed inside, and he seemed just to indulge in a little now and then. What he enjoyed most was having a bath.

Suggestions for getting rid of Loranthus longiflorus.

6. The only way of ridding the tree of the parasite is to lop off the branch on which it subsists, as explained in that interesting translation of Hartig's Book on Diseases of Trees by Somerville and Marshall Ward, and this is the method adopted

in Thána. The Forest Blocks here are sub-divided into coupes, one of which is out every year and closed. In these coupes several standards (about 30 or 35 to the acre) are left standing, and it is usually on the Teak standards that the *Dicaeum erythrorhyncus* deposits the *Loranthus longiflorus* seeds. When the controlling officer comes round, he expects to find all the standards in the coupe exploited during the previous year free of parasites. Sometimes there are a few, at other times many* parasites in a coupe, but never too many for a Forest Guard with the aid of a few village friends to remove. In this way the growth of a large number of trees is annually improved. There is a danger, of course, in Forest Guards, through carelessness or by design, lopping off more of a branch than is absolutely necessary; but if the operations are localised to the coupe of the preceding year, strict supervision over them will not be difficult to maintain. In many instances, where apparent abuse of the practice was noticed, it was found that the explanation submitted by the Forest Guard was satisfactory. The *Loranthus* had taken root on the leading topmost shoot growing out from a perpendicular stem, so that decapitation of the stem was the only course possible. Killing the bird so as to effectually arrest the spread of the parasite for ever and a day, is a measure I would not suggest, for, apart from the cruelty of such a step it would be impracticable, as a small army of special Guards with guns would be needed to shoot the birds and destroy their nests, and then they might not destroy the right birds, for there are several very like the *Dicaeum erythrorhyncus* in appearance in the forests which are insectivorous.

Conclusion.

7. My observations, therefore, are, as already stated, entirely opposed to those of Mr. Keeble, whose investigations were undertaken in Ceylon, where probably the genus *Dicaeum* may be a different characterised bird; but I should hardly think it, for so far away as in Victoria the same genus, as shown by Mr. Ashworth, exists, with characteristics almost exactly similar to the Indian species. The only difference in the method of eating the fruit between the Indian and Australian species is that the former does not open the so-called lid, as shown in the diagram accompanying Mr. Ashworth's paper, but squeezes the seed out of the epicarp with his bill by pressure at the opposite end.

G. M. RYAN,

Deputy Conservator of Forests,

18th June 1899.

South Thána.

**Loranthus* is very abundant in the western portion of the Murbád Taluka.

Notes on the Tubers of the Climbers *Dioscorea bulbifera*.

. Introduction.

No mention being made in the Gazetteer of the Bombay Presidency, Volume XXV (Botany), of the important climber *Dioscorea bulbifera* (called Kurva, Karand or Kand in Thána), and from the remark in paragraph 56 of the Northern Circle Annual Report for 1896-97 of the Bombay Presidency, including Sind, the economic value of its tubers as an article of food not being apparently generally known, a short note on this useful plant may not prove uninteresting. Mention of the climber is made in Volume III of Dr. Watt's Dictionary of Economic Products (page 128), but the details I now give regarding its tubers and their preparation for food do not appear in this volume.

Where the tubers are found.

2. The climber possesses tubers which are found about 6" to 1' in the ground at the foot of Ain (*Terminalia tomentosa*), Dhowra (*Agnogeissus latifolia*) and Teak (*Tectona grandis*) saplings chiefly; but it is also to be seen in the open away from tree growth in rocky places, where it is a crawler over rough rocky ground. The tubers are formed in the monsoon months (July-August), and after about 8 or 9 months shrink up, leaving only the outer rind in the soil. Before dying in this manner new tubers are thrown out.

Size of tubers.

3. The size of the tubers varies with the character of the soil. If soft they are large, each having a diameter of 3" or 4". If the soil be hard and gritty, they are small and grow in clusters like small potatoes.

By whom eaten.

4. The wild tribes, Thákurs especially, in the eastern talukas of the Thána District eat these tubers in ordinary years extensively, and in seasons of scarcity, as in 1896-97, live on scarcely anything else. In ordinary seasons they commence collecting the tubers as soon as their supply of food-grains ceases. In the month of March 1897, during the famine, I saw large numbers of women and children belonging to the wild tribes grubbing up these tubers from the ground, both in the open and closed forests: an operation which, of course, was not objected to, it being of material assistance to the Forest Department, which is anxious to rid the younger trees of such climbers. Apart from their habit of climbing on their hosts, the roots, which are in close proximity to the latter in the ground, as a rule must usurp a lot of the nutrients in the soil intended for the tree.

Method of preparing the tubers for food.

5. The tubers are dug out of the soil and washed in clear water and then boiled : after this they are peeled and cut in thin slices and placed in a basket, which is put during the night in running water. In the morning the basket is removed and the tubers taken out and eaten with salt. They are also eaten with milk, and when taken in this manner are much appreciated.

The above process of preparing the tubers for food is resorted to during the monsoon. The process employed in the hot weather is as follows :—

The tubers are peeled and cut into slices, and the latter are buttered with ashes of *Phaseolus mungo* (*black-gram) husks and then boiled. After this the slices are washed and re-boiled with salt, and eaten. The process of boiling twice is resorted to, to mitigate the bitter taste of the tubers. If the ashes of the husks of black gram are unobtainable, ordinary ashes from a wood fire are used to butter the slices of the tubers

Report of analysis of tubers by Mr. Hooper, F.I.C., F.O.S.

6. I have received* copy of a report on the analysis of a sample of tubers made by Mr. D. Hooper, F.I.C., F.C.S., Curator, Economic and Art Section, Indian Museum, Calcutta, in which he mentions that the dietetic value of these tubers, compared with potatoes, shows that the amounts of the proximate constituents are very similar and the tubers appear to be equally nutritious. The copy of the report is as follows :—

"The fresh tubers submitted to chemical analysis afforded the following constituents :—

Water	...	...	69.48
Fat, resin, &c.	...	...	3.18
Albuminoids	...	...	1.90
Starch and mucilage (carbohydrates)	...	...	21.97
Fibre	...	...	1.93
Mineral matter	...	...	1.54

100.

"For the sake of comparing the dietetic value of these tubers with that of the potato, the following results of the analysis of this well-known food is reproduced from Dr. Parke's 'Practical Hygiene' :—

Water	...	...	74.0
Albuminoids	...	...	1.5
Fat	...	...	.1
Carbohydrates	...	...	23.4
Mineral matter	...	...	1.0

100.

*Marathi name *Udid*

"It is here shown that the amounts of the proximate constituents are very similar and the tubers appear to be equally nutritious.

"Certain varieties of yams, however, especially the wild kinds growing in Asia and Africa, have been reported to be poisonous. The toxic principle has been shown to be a glucoside, which is readily removed by water or dispelled by heat. The sample under notice contained a small proportion of a bitter principle. The under-ground tubers of cultivated yams are said to be free from any injurious property, but it would be safer in all cases where wild yams are concerned, to soak them in water, boil and roast them before they are eaten."

G. M. RYAN.

Deputy Conservator of Forests,

13th June 1899.

South Tháns.

*Through the courtesy of Major Prain, I. M. S., Royal Botanic Gardens, Calcutta.

IV.-REVIEWS.

Forest administration in Sind during 1897-98.

The year 1897-98 has again been an uphill one for the department in the Sind Forest Circle. It may be remembered that during the previous year the department had experienced considerable difficulty. Pestilence raged throughout the province, and when quarantine and other restrictions were first imposed, there was a widespread scare amongst the coupe contractors and their workpeople, resulting in considerable loss both financially and in the carrying out of the forest operations of the year. The same conditions prevailed during the year under review, even perhaps in a more aggravated form. "At one time it was considered that the unfortunate conditions of the previous year had run their course, but this hope was momentary. Soon after the annual sales were held, a ring was formed amongst the large contractors of the Hyderabad Division for the purpose of drawing back from their undertakings with the department, by fair means or foul, resulting in the plan of operations being adhered to only to a very small extent." The financial results of the year are, therefore, somewhat disappointing, showing a decrease in the receipts of Rs. 50,000 as compared with the previous year; and a decrease of Rs. 1,50,000 as compared with the normal year 1895-96. The total revenue of the year amounted to Rs. 2,67,114 and yielded a surplus of Rs. 1,27,308.

In the same way and for the same reasons the exploitation of the annual coupes became a matter of great difficulty. Out of 139 coupes of the year, measuring 14,252 acres, only 75, with an area of 8,701 acres were sold, and 1,403 acres were worked on the royalty system from which branch-wood alone was cut and removed to meet the requirements in fuel of the North-Western Railway between the Kotri and Amri Stations.

These same peculiar conditions, though naturally more markedly apparent in the case of the outturn of the forests, were equally found to exert their influence on all the operations of the year. Not only directly, but also indirectly, in that officers were either placed on special duty, or were expected to concentrate their energies in enforcing measures for the suppression of the plague. Consequently, little progress could be made in the more important works of preparing Working Plans, of carrying out Settlement operations, and the consequent demarcation and survey of forest areas. Nevertheless, it is satisfactory to find that a good deal of good forest work was carried out during the year, and the protection and improvement of the forests was not lost sight of.

In the Sind Forest Circle the area of the Government forests amounts approximately to 1,059 square miles. This area, however, does not appear to have ever been properly demarcated or surveyed; and, consequently, large discrepancies have been found to exist between the areas shown in the statistical returns of the Agricultural Department and those given in Forest Form No. 46. These errors will be remedied by slow degrees as the Working Plans party visits each Division and surveys the forests, and some work in this direction has already been carried out in the Hyderabad Division. It is difficult to understand, however, why the Conservator should decline the assistance of the Forest Survey branch. It is true, as he explains, that such a survey would be "costly"; but when the Department is undermanned, and considerable difficulty is thereby experienced in obtaining duly qualified men for the Working Plans division, it surely is false economy to insist on carrying out the work departmentally. A second and ever-present factor in causing considerable annual alterations of area is the river Indus. The extent to which the vagaries of this river may alter the boundaries of the forests may be gathered from the fact that during the year under review, a by no means exceptional one, the total area lost by erosion amounted to 20,301 acres as against 27,103 acres gained. The erosion naturally causes great loss of valuable timber, and it is satisfactory to find, from a purely financial point of view, that considerable activity was shown in saving the timber on threatened banks from falling into the river. The net value of the wood-trees saved was considerable, amounting to Rs.11,000. In this connection it will be interesting to quote the Conservator's remarks on the subject:—

"Erosion operations are beset with considerable difficulties, which can only be fully realised by those who have to undertake them. A glaring instance out of the many misapprehensions that appear to exist is the remark in paragraph 8 of the last review that, "at the threatened strips, water carriage is more easily available than at any other time," which I take the liberty of correcting, as unfortunately the reverse has been found to be the case in actual practice. To fell the trees down on eroding banks is easy enough, and it is as a rule expeditiously effected; but it is the removal of the felled material either to a safe place inland, or up or down the bank where boats can approach with safety which is attended with danger and difficulties, and is not only irksome, but costly, as no boatman dares risk his life and property by making fast to a cutting bank from fear of tons of earth falling and wrecking his boat. Moreover, owing to the suddenness with which erosion attacks the banks, it is often necessary to shift the material several times from place to place before it can be transported."

The slow progress made during the year and the present unsatisfactory state of the Settlement operations, although much to be regretted, could not be avoided for reasons explained above: but it is to be hoped that strenuous endeavours will be made to expedite matters. As the Conservator very correctly remarks—"the longer the interval that lapses between the issue of the notifications under Secs. 4 and 19, the worse is the fate of the areas proposed for reservation, as the reports received show that the tree-growth on them, unguarded as it is, is being mercilessly hacked and wantonly damaged by goatherds and other village population." The recent orders of the Commissioner on the subject should, however, put a stop to this state of affairs.

The information to be derived from the Annual Report on the subject of Working Plans is extremely scanty, and leaves a great deal to be desired. Indeed, the whole subject is disposed of in a table which reads as follows:—

1	Area organized	...	225	square miles
2	Test trees observed	..	4,187	
3	Compartments described	...	702	
4	Working Circles described	...	67	
5	Forests described	...	37	
6	Linear miles surveyed	...	590	miles.
7	Boundary marks erected	...	240	
8	Compartment numbers branded	.	1,710	
9	Maps and tracings prepared	...	225	
10	" " completed	...	28	
11	Sections plotted	...	6	
21	Photos of forest views taken	...	12	

The above having been carried out wholly in the Hyderabad Division, and by one Working Plans officer, an Extra-Assistant

Conservator, it is to be regretted that more details are not given in the body of the report.

In the other Divisions the want of Working Plans appears to be sadly felt. The Conservator considered it advisable to revise the plan of exploitation in consultation with the respective Divisional Forest Officers, "*as it was noticed that a haphazard and irregular method of selecting coupes prevailed in some Working Circles.*"

In other respects, particularly as regard silvicultural operations, and for the protection of the forests, the Department deserves much credit. It will be seen that fire-protection was eminently successful in all divisions, not only in that the total recorded number of fires during the year was reduced from 72 to 49, but also that the area traversed (15,000 acres) was about two-thirds less than that of the previous year. It is pleasant to read the Conservator's remarks on the subject. He writes :— "There is no doubt that fire discipline has attained a creditable state of efficiency—the people turn out as a rule most willingly and help in extinguishing the fires." And the results are all the more surprising when it is found that all this was accomplished without any expenditure having been incurred on special protective measures, "that is, no fire-traces were burnt or special watchers employed, but particular attention was paid to the clearing of compartment lines and other boundaries on the perimeter of the forests."

It is disappointing, however, to find that so little was done to discover how the 49 fires originated. "Leaving out of account the three fires caused by sparks from a passing locomotive, the origin of only one fire was brought home to the carelessness of the cultivators of a neighbouring zamindar burning rubbish near the forest boundary. How and by whom the other fires (64) originated remained a mystery." Perhaps the employment of a few fire-watchers might help to solve the mystery.

A great deal of good work was accomplished in carrying out repairs to existing boundary marks, and in the clearing and general up-keep of boundaries. It appears that 16,022 boundary marks and 1,698 miles of boundary paths were repaired, and this work, valued at Rs. 4,946, was carried out by the free-labour of cattle-breeders residing within forest limits and of villagers resorting to the forests for the purpose of grazing and the enjoyment of other forest privileges. The Department in Sind appears to have solved the difficulty of getting forest work carried out for nothing, or to express it more correctly, of obtaining some return for the privileges enjoyed by the surrounding villagers. For, in addition to the maintenance and construction of boundary pillars, and of boundary roads, and in addition to the help obtained in fire-protection we find that 602 miles of fencing were erected, repaired

and maintained free of cost by the aid of the population resident in and near the forests ; the estimated value of the work amounting to Rs. 5,078. It would be interesting to obtain further details regarding the working of this system of free labour.

The climatic conditions of the year were highly favourable to natural reproduction, and a high flood, a good seed year, rainfall not so scanty as in ordinary years, and a mild winter, combined with effective fire-protection, have left their beneficial effects on the future of the forests. Similarly, artificial reproduction under the system of giving out blank areas to agriculturists for cultivation on a year's lease in conjunction with sowing of babul and other forest tree seeds shows some excellent results. The system, however, is one which requires careful supervision, as shown very clearly by the Conservator in his report, where a zamindar, in order to get a second year's cultivation, deliberately ruined a plantation. Considerable success has been obtained in the introduction of two species, the babul (*Acacia Arabica*), and the tali (*Dalbergia Sissu*) ; and the seedlings of this species covering an area of 1,800 acres are doing remarkably well. The same cannot be said of other "experiments." Experiments with the rain tree (*Juga sama*) were made in all divisions and have resulted in failure. The seedlings, whether watered or not, after transplanting in kalar lands, invariably died, though in sweet soils, they thrive pretty well, if protected from frost for the first year or two. Similarly, experiments with the Anjan (*Hardwickia binata*), the sahai grass, and the sisil hemp (*Agave sisalana*) have given very indifferent results.

The forest offences detected or reported during the year number 2,670, as compared with 2,299 cases reported during the the previous year ; and illicit grazing constitutes the bulk of these offences, (2,163 cases). As in other parts of the Bombay Presidency the number of offences is very large, and the protective staff appear to have to deal with a somewhat unruly set of offenders, as may be judged from two instances, which we will quote from the report :—

Under 'Other offences' are included 9 cases of using criminal force against subordinates while in the execution of their duty. In all divisions, rescue of cattle on its way to the pound has been attempted. One important case, however, was of a very serious nature, as in the *mêlée* which ensued not only was the Forest Guard most badly treated, but of two men who had gone with him to render assistance one lost his life and another was very seriously wounded. Eight of the accused were convicted and sentenced to terms of rigorous imprisonment varying from 7 to 2½ years, and the fines inflicted on them in addition ranged from Rs. 250 to Rs. 50. One of the accused has made himself scarce and has not been heard of since. The Sessions Court awarded Rs. 40 as compensation to the Forest Guard, Rs. 200 to

the father of the man who died, and Rs. 100 to the person who was wounded in the affray."

Again, "The Divisional Forest Officer, Sukkur, complains that the year of this report was one of great trial for the Forest Guards in the Mirpur and Ghotki ranges. The relatives or friends of the persons who had been defying openly all their efforts to keep out cattle from areas under reproduction, and whose cattle had been frequently impounded, conspired and laid false charges against them before the then District Magistrate. The charges, as it was expected, could not be substantiated in the least particular, and all cases (5) were dismissed by the trying Magistrate."

An interesting question has arisen as to whether certain grazing concessions enjoyed by villagers are *rights* or *privileges*, a question of the very greatest importance to the Department, especially in Sind, where reproduction is a matter of difficulty and the occasional closing of certain areas a necessity, and, moreover, where no less than 2,700 head of cattle per annum are at the present moment allowed free grazing. In the report for 1896-97 the Commissioner wrote on this subject that "more than 90 per cent. of free grazing is not a concession, but a right granted under Settlement." The Conservator's reply to this proposition is "that *right* to free grazing has not been recognized in any of the reserves of the Sind Circle. On the recommendation of the Forest Settlement Officer, Government have conceded the privilege of free pasture to certain villages, subject to certain restrictions." To which the acting Commissioner gives the following reply:—"With reference to the Conservator's distinction between *right* and *privilege*, the Acting Commissioner considers it to be a distinction without any real difference. The "right" granted under Settlement did not the less apply to their privileges because they were conceded on conditions." It is to be hoped that a final and unimistakeable ruling will be obtained on the subject, as there does exist a very real and a most important difference between *right* and a *privilege*. A few years ago there were no rights in Sind: but if we correctly interpret the Conservator's remarks that "on the recommendation of the Settlement Officer, Government has conceded the privilege of free pasture to certain villages," then Government has probably thereby created a right, unless the concession is removeable at pleasure. And if a right has been created, it is only to be hoped that the "restrictions" to which it is subject are all-sufficient for the successful working of the forests in the future.

VI.—EXTRACTS NOTES AND QUERIES.

Botany and the Indian Forest Department.

In the issue of "Nature" of this date I find the second part of Sir G. King's presidential address of section K, Botany, delivered at the Dover Meeting of the British Association. At the end of that address Sir G. King has made a strong attack on the Indian Forest Department, and on the teaching of Botany at Cooper's Hill College. He maintains that the forest officers trained in this country go out to India with an insufficient knowledge of systematic botany, and that they, on arrival in India, are not encouraged to familiarise themselves with the contents of the forests under their charge.

These assertions are in some respects not in accordance with the facts of the case, and in others they show that Sir G. King, in spite of his long Indian experience, has failed to grasp the real issues. I trust you will permit me to substantiate these two points.

To begin with. Sir G. King puts the cart before the horse. If, as he maintains, the ordinary forest officer educated in England now arrives in India without sufficient knowledge to enable him to recognise from their botanical characters the most well-marked Indian trees, it is chiefly due to the fact that it is now-a-days impossible to secure a botanical teacher in this country who can impart the necessary knowledge to the students. Sir G. King feels this himself, hence his lamentations, at the end of his address, over the decay of the study of systematic botany in Britain. I feel sure that Sir W. Thiselton Dyer will bear me out when I state that no botanical teacher has been appointed to Cooper's Hill College except with his, and latterly also with Dr. D. H. Scott's advice. They have been good enough to recommend to us the gentlemen whom they considered most suitable for our requirements, but, alas! not one of them, though all were excellent and even famous botanists in other respects, was a systematic botanist in the sense demanded by Sir G. King. Hence I must turn round upon him and say:—"Provide well-equipped systematic botanists, and we shall be only too glad to have one of them." In other words, the main difficulty lies with the botanists of the present age, and not with the Forest Department.

On the other hand we are not free from blame. Until the year 1880, botany was a compulsory subject in our entrance examination, but in that year it was, against my advice, made an optional subject. This, I believe, was due to the influence of the head-masters of our great public schools, who desired to pass their pupils straight into the Service, without being obliged to teach

special subjects, such as botany. I do not desire to discuss the general question here involved, but I do wish to state that the action in the direction just indicated was decidedly injurious to our special requirements. I am happy to say that during the last year botany has once more been placed amongst those subjects, which every candidate for entrance into the forest branch of Cooper's Hill College will have to take up.

As for myself, I may state that, ever since I started the forest branch of this College in 1885, I have constantly urged our botanical teachers to extend the study of systematic botany at the expense of other branches, such as physiology. But what with young men trained on the ordinary lines of our public schools, and with teachers with a decided leaning to branches of botany other than systematic, it has been a hard struggle. The otherwise excellent teachers of botany, whom we have had so far, did their best to take up systematic botany on the lines required by us, but that is a branch not learned in a day, and the first two of our botanists left us, for better appointments than we could offer, when they had fallen in with our requirement.

And yet I think Sir G. King goes too far when he states that the ordinary forest officer educated in England is unable to recognise from the botanical characters the most well-marked Indian trees. Cases like this do, no doubt, occur, but I am sure that Sir G. King's assertion does not hold good in the case of many of the men who have been sent to India. Indeed, several of them have developed a decided leaning towards systematic botany. At the same time, the task is, in a great part of India, far more difficult than would appear from Sir G. King's words. I should like to know what he understands by "the most well-marked Indian trees." There are some 4,000 different species of trees and woody shrubs in Burma and about half that number in Bengal-Assam. If Sir G. King expects our forest officers on arrival in the country to recognise even a moderate fraction of these species, then he aims at impossibilities, and his enthusiasm for systematic botany has carried him far beyond reasonable limits. To do what he requires demands a thoroughly trained botanical specialist, and even such a one would require many years to become acquainted with the trees, shrubs and herbs (as demanded by Sir G. King) of an Indian jungle in Burma, Bengal and many other parts of India. For such things the ordinary Indian forest officer has no time.

The statement made by Sir G. King, that the young forest officer on arrival in India is not encouraged to familiarise himself with the contents of the forest under his charge, is not in accordance with the facts of the case. On the contrary, it is made the first duty of the young officer, apart from the study of the language of the people. Sir G. King himself enumerates fourteen forest officers who, during the last thirty years, have done good botanical work. Of these, five have made important contributions to

the systematic botany of India. Of the other nine, one was trained at Cooper's Hill. Considering that all the men sent out from Cooper's Hill are as yet young, and that to my certain knowledge several of them are likely to become botanists, I think Sir G. King's strictures are not justified. Unfortunately, he looks at the matter entirely from an enthusiastic botanist's point of view.

The Government of India does not wish every Indian forest officer to be a botanist. It is desirable that every now and then one of them should take up the subject as a speciality, but it would be disastrous if all took that line. I have no hesitation in saying that as soon as a forest officer takes up botany as a speciality he is, rare cases excepted, likely to become an indifferent forest officer. The ordinary officer of that class has no time for special botanical study.

Forestry is, perhaps, not a science in itself, but an industry based upon various branches of science, amongst which botany, geology and entomology are the most important. The forest officer cannot be an expert in each of these. To demand such a thing would be just as reasonable as to demand that a medical man should be an expert in chemistry. The one is as impossible as the other; to become either takes practically a life-time. With the enormous growth of the several branches of science, a very minute specialisation has become an absolute necessity, since only a small fraction of men can be called geniuses, while the rest must be rated at the average capacity of the human race. The students of one branch must depend on the work of students in other branches. Thus, the forester, instead of being the assistant of the botanist (as Sir G. King seems inclined to demand), must rely on the professional botanist for all the finer and more intricate problems of botany. All he requires is to acquire a sufficient knowledge of botany, so that he may utilise what the professional botanist tells him. For more he has no time, because he has to attend to quite another class of business. The Indian forest officer is an estate manager on a large scale; he must manage his estates in such a manner that they yield the largest possible amount of useful produce with the least possible outlay. For that end his time is taken up by silvicultural and administrative duties leaving but little of it for the special study of any of the branches of science upon which systematic forest management is based.

No doubt many of the pioneers of Indian forestry were botanists, but by no means all. Take, for instance, the protection of the forests against fire, a matter to which Sir G. King gives prominence. He himself states that Lieutenant (now General) Michael was the first who was successful in this direction in Madras. I may add that as far as Central and Northern India are concerned, Colonel Pearson was the first to introduce successful fire conservancy. And yet, neither of these two gentlemen will, I feel sure, claim to be a great botanist.

Sir D. Brandis, to whom, as Sir G. King points out, we owe, for the most part, the organisation of the Indian Forest Department, no doubt was a botanist; but he brought about that organisation, not as a botanist, but as an able forester and administrator of extraordinary energy.

Botany is a branch of science the study of which is most fascinating; but the faculties which produce a great botanist do not necessarily include those which are required to produce a great administrator, and herein lies the difficulty, in so far as the Indian Forest Department is concerned. I could point out more than one botanist who occupied the post of the head of the Forest Department in a province, and who could not be counted amongst the successful forest administrators of India. In nearly all these cases so much time was given to botany that little—or, at any rate, not enough—time remained for the proper administration of the extensive Government forest estates which supply the people of the country with the necessary forest produce, and over and above yield now an annual net revenue of a million pounds. These results would be most seriously imperilled if our Indian forest officers were to take the line which Sir G. King recommends to them.

Cooper's Hill, October 19th.

(Sd.) W. SCHLICH.

From "Nature" of November 2nd, 1899.

Yield Table for Shisham Seedlings at Changa Manga.

I am sending you a yield table for seedling shisham forest at Changa Manga, which may be useful to some of your readers for comparison with the rate of growth, &c. of shisham in other localities and under other conditions than at Changa Manga.

The table is as accurate as I think can be prepared from the available data, and as the plantation has been once worked over, no further data with regard to the rate of growth of seedling shisham will be available for some time. There are sure to be inaccuracies in it, but it is to be hoped that some other officer will undertake to improve on it, as I shall have no further chance of doing so, having been transferred from the Lahore Division to Rawalpindi.

RAWALPINDI,

B. COVENTRY.

12th November, 1899.

Normal growing stock of Shishim (Dalbergia sisu) at Changa Manga calculated for an area of one acre.

1.-QUALITY.

Age.	VOLUME OF GROWING STOCK IN CUBIC FEET SOLID.				VOLUME OF NORMAL SERIES OF AGE GRADATIONS.			
	Number of trees	Diameter of mean tree at 4 ft. above ground.	Height in feet of mean tree.	Material over 2 inch diameter cft. solid.	Faggots 1 in. to 2 in. cft. solid.	Brushwood under 1 in. diameter cft. solid.	Total of all classes in cft. solid.	M. A. I. cft. solid.
1	...	8	4.6	10	1	2	13	13
2	...	1.5	9.3	34	3	4	20	27
3	...	2.2	13.4	75	6	8	41	54
4	...	2.9	17.4	127	11	14	80	103
5	1,023	3.5	21.2	193	20	20	162	235
6	808	4.2	25.0	273	25	29	246	331
7	653	4.8	28.5	337	32	33	332	431
8	540	5.3	32.0	495	42	50	467	583
9	436	6.0	35.5	623	52	63	567	722
10	350	6.5	38.7	785	63	77	744	906
11	224	7.1	42.0	912	74	91	905	1,077
12	234	7.7	45.0	1,063	87	107	1,257	1,452
13	180	8.2	49.0	1,231	96	123	1,452	1,664
14	152	8.7	50.4	1,412	111	141	1,664	1,896
15	130	9.3	52.8	1,600	126	160	1,896	2,113
16	120	9.8	55.0	1,785	133	180	2,113	2,349
17	105	10.3	57.1	1,996	153	200	2,349	2,601
18	95	10.8	59.0	2,210	169	232	2,601	2,860
19	90	11.3	60.5	2,435	182	243	2,860	3,103
20	83	11.7	62.0	2,642	196	265	3,103	3,355

Normal growing stock of Shisham (Dalbergia Sissoo) at Channa Manga calculated for an area of one acre.

III —QUALITY.

YIELD TABLE FOR SHISHAM SEEDLINGS.

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Age.	Number of trees per acre.	Diameter of mean tree @ 4½ feet.	Height in feet of mean tree.	VOLUME OF GROWING STOCK IN CUBIC FEET SOLID					VOLUME OF NORMAL SERIES OF AGE GRADATIONS				
				Material over 2 in. diameter.	Faggots 1 in. to 2 in. off.	Brushwood under 1 in. diameter.	Total of all classes.	M. A. I. in off. solid.	Material over 2 in. diameter.	Faggots 1 in. to 2 in. off. solid.	Brushwood under 1 in. diameter.	Total of all classes.	M. A. I. in off. solid.
1	...	9.6	32.2	5	..	1	22	5	5	..	..	5	5
2	...	10	6.4	20	1	4	51	11	25	1	1	27	13
3	...	14	9.3	44	3	8	90	17	69	4	5	78	26
4	...	19	12.0	77	5	12	132	22	146	9	13	168	42
5	...	23	14.6	112	8	16	184	26	236	17	25	300	60
6	...	28	17.4	157	11	23	250	30	415	28	41	484	80
7	1,000	32	20	212	15	25	310	35	627	43	64	734	105
8	820	36	22.5	264	19	35	390	39	891	61	92	1,044	130
9	690	41	25	313	22	43	472	43	1,224	83	127	1,434	169
10	570	45	27.4	402	27	51	561	47	1,626	110	170	1,908	190
11	485	48	29.9	478	32	59	649	51	2,104	142	221	2,467	224
12	420	52	32.1	553	37	69	752	54	2,657	179	280	3,116	259
13	370	56	34.2	641	43	78	864	58	3,298	222	348	3,863	297
14	320	60	36	738	48	84	983	62	4,036	270	426	4,832	346
15	295	64	38	823	53	87	1,084	64	4,859	423	513	5,795	385
16	275	67	39.6	907	60	97	1,084	66	5,765	483	610	6,859	428
17	260	71	41.3	1,010	65	107	1,182	69	6,776	548	717	8,041	473
18	250	74	42.8	1,094	70	116	1,290	71	7,870	618	833	9,321	517
19	240	77	44	1,204	76	128	1,408	74	9,074	694	961	10,729	564
20	230	8.1	45.4	1,310	83	139	1,532	76	10,384	777	1,100	12,561	613

Yield Table of fuel from Shisham (Dalbergia Sissu) seedling forests at Changa Manga calculation made for one acre.
I.—QUALITY.

Age	YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE CLEAR FELLED.					YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE WITH 15 STANDARDS RESERVED.				
	Fuel from 2 in. to 1 in. diameter in cft. stacked.	Fuel from 2 in. to 1 in. diameter in cft. stacked.	Brushwood under 1 in. diameter in cft. solid.	Total of all classes in cft. solid.	M. A. I. in cft. solid.	Fuel over 2 in. diameter in cft. stacked.	Faggots 1 in. to 2 in. diameter in cft. stacked.	Brushwood under 1 in. diameter in cft. solid.	Total of all classes of fuel in cft. solid.	M. A. I. not including standards. cft. solid.
1	17	5	2	12	12	14	47	1-0	10	10
2	56	19	4	41	20	52	17-6	3-0	37	16-5
3	124	40	8	84	28	117	36-9	7-2	79	26
4	210	68	14	144	36	200	62-8	12-4	138	34
5	325	100-2	20	220	44	310	93-7	19	209	42
6	456	142	29	317	52	432	129-6	27	297	49
7	635	186	38	425	60	588	170-8	36	400	57
8	813	235	50	550	69	768	216	47	519	65
9	1,032	295	63	694	76	972	265	59	653	72
10	1,255	359	77	844	84	1,180	319	72	792	79
11	1,418	419	91	1,006	90	1,406	374	85	943	95
12	1,744	459	107	1,187	98	1,632	437	115	1,108	92
13	2,020	554	123	1,366	105	1,865	494	131	1,272	98
14	2,316	627	141	1,557	110	2,156	557	148	1,447	103
15	2,625	706	160	1,770	118	2,430	622	166	1,633	109
16	2,945	781	180	1,965	124	2,720	686	185	1,830	115
17	3,275	881	200	2,112	130	3,026	758	205	2,038	120
18	3,625	945	222	2,451	135	3,348	828	224	2,257	125
19	3,995	1,025	243	2,678	141	3,686	893	244	2,466	130
20	4,333	1,102	265	2,917	145	4,000	960	244	2,684	134

Yield Table of fuel from Shisham (Dalbergia Sissu) seedling forests at C'angu Manga, calculation made for one acre.
 II.--QUALITY.

Age	YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE CLEAR FALLOW.				YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE WITH 15 STANDARDS RESERVED					
	Over 2 in. diameter cft. stacked.	From 1 in. to 2 in. diameter cft. stacked.	Brushwood under 1 in. diameter cft. solid.	Total in cft. solid.	M. A. I in cft. solid.	Fuel over 2 in. diameter cft. stacked.	Faggots from 1 in. to 2 in. diameter cft. stacked.	Brushwood under 1 in. diameter cft. solid	Total in cft. solid.	M. A. I. cft. solid.
1	11.5	4	6	7	7	10	3	5	6	6
2	43	13	2	28	14	40	12	2	27	13
3	94	26	5	61	20	90	25	5	60	20
4	166	45	9	110	27	160	44	9	107	27
5	247	69	14	167	33	240	66	14	162	32
6	351	94	21	236	39	336	91	20	226	37
7	470	126	28	317	45	448	119	27	302	43
8	606	164	37	409	51	576	152	35	389	48
9	757	203	46	512	57	720	188	44	486	54
10	928	243	56	625	62	880	225	53	592	59
11	1,116	293	67	751	68	1,056	266	64	711	64
12	1,305	345	79	881	73	1,236	311	75	832	69
13	1,512	393	92	1,019	78	1,430	356	87	962	74
14	1,721	448	105	1,160	82	1,624	403	99	1,092	78
15	1,965	499	117	1,321	88	1,845	450	112	1,239	82
16	2,221	559	136	1,516	94	2,080	499	127	1,417	87
17	2,469	615	151	1,661	98	2,312	546	141	1,551	91
18	2,736	671	166	1,839	102	2,556	596	155	1,713	95
19	2,979	734	182	1,995	105	2,774	646	169	1,850	98
20	3,225	794	197	2,163	108	3,000	700	183	2,012	100

Yield Table of fuel from Shisham (*Dalbergia Sissoo*) seedling forests at Changa Manga, calculation made for one acre.
III. - QUALITY.

Age	YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE CLEAR FELLED				YIELD OF FUEL IN CUBIC FEET STACKED FROM ONE ACRE WITH 15 STANDARDS RESERVED.					
	Fuel over 2 in. diameter cft. stacked.	Faggots. Fuel from 1 in to 2 in diameter cft. stacked.	Brushwood under 1 in. diameter in cft solid	Total of all classes in cft. solid.	M. A. I. in cft. solid.	Fuel over 2 in. diameter cft. stacked	Faggots. Fuel from 1 in. to 2 in diameter. cft. stacked	Brushwood under 1 in diameter cft. solid.	Total of all classes in cft solid.	M. A. I. not including standards cft. solid.
1	10	4	5	6	6	8	22	5	6	6
2	34	10	2	28	14	32	8	2	27	13
3	72	19	4	43	16	69	17	4	46	15
4	123	30	8	85	21	120	28	7	82	20
5	184	46	11	123	24	180	43	11	119	24
6	260	63	16	174	29	252	59	15	168	28
7	348	81	21	233	33	336	77	20	224	32
8	434	103	26	280	36	416	97	25	278	35
9	547	128	33	365	40	522	121	32	348	38
10	660	157	40	442	44	630	145	38	421	42
11	785	182	48	525	48	748	167	45	499	45
12	909	210	55	607	56	864	192	52	576	48
13	1,053	235	64	704	54	1,001	216	61	668	51
14	1,211	274	73	809	57	1,149	244	69	764	54
15	1,350	303	82	932	60	1,275	270	77	849	56
16	1,487	356	90	994	62	1,408	299	85	938	58
17	1,657	366	100	1,106	65	1,564	326	94	1,040	60
18	1,797	398	109	1,199	67	1,692	353	102	1,126	62
19	1,977	432	120	1,319	69	1,862	380	112	1,237	65
20	2,150	464	130	1,434	71	2,020	408	122	1,342	67

Reducing Factors.

100 cubic feet stacked = 57 cubic feet solid for fuel over 2 in. diameter.

do do do under 2 in. do.

Brushwood estimated @ 10 per cent. of total outturn. Loss in conversion estimated at 7 per cent. of total outturn. 1 cubic foot solid dry shisham = 58 pounds

B. COVENTRY.

Bleeding of Woody Plants.

Professor H. Molisch has made a variety of observations on the flow of sap from woody plants when wounded.

In the case of Palms, Cocos and Arenga, the bleeding, when the inflorescence is amputated, is not due to root-pressure. No sap escapes from borings at the base of the stem, though it pours out abundantly at higher parts, even at a height of 19-28 metres, when the tree is in full leaf. The spadix continues to bleed for one or two days after being amputated. The origin of the o-motic pressure appears, therefore, to be not in the root, but in the axis of the inflorescence in Cocos, and in the upper part of the stem in Arenga. In three woody plants, natives of Java, (*Onocephalus azureus* (Moraceæ), *Laportea crenulata* (Urticaceæ) and *Bambusa* sp. there is an abundant bleeding from the stem, with very considerable pressure, up to two atmospheres, even at the time when the plant is in full leaf. The temperature during (our) winter months is very high day and night, with a constantly cloudy sky and daily rains. From incisions in the stem of climbing plants there is a copious flow of sap, both in the tropics and in European species. The sap flows from the vessels, thus explaining their unusual size in climbing plants. The flow is a purely physical result of the exposure of the vessels on both sides, and shows that capillarity cannot play the part either of a water-retaining or of a water-raising force to any considerable extent. The phenomenon takes place in *Vitis* and *Climatis*, in the height of summer even in very dry weather and intense heat.—(*Journ. Royal Micro. Society.*)

Origin of Storax.

At the 12th International Congress of Medicine at Moscow, Herr J. Moeller, who has been occupied for the last 20 years in studying the origin and development of storax, recently showed that this balsam is not produced in the bark, but is formed in the wood; that it is not a physiological secretion but a pathological product which arises after damage to bark or wood. The first effect of a wound is a development of schizogenous glands which are subsequently converted into lysigenous spaces. These facts were verified both for styrax liquidus from *Liquidambar orientalis*, and for sweet gum from *Liquidambar styraciflua*. The experimental proof was furnished by L. Planchon, who found that balsam did not exist in normal plants, and that it occurred only after wounding the tree. The author supports this by noting the result of making semicircular cuts in a *Liquidambar styraciflua* 6 metres high. Where the branches were not wounded there was no trace of balsam; but where the damage had affected the cambium, rows of balsam glands could be detected with a lens. It seems, therefore, indisputable that storax is a pathological product.—(*Journal of the Royal Microscopical Society.*)

Physiology of roots.

Herr A. Rimpach classifies roots under four heads, *viz.*, (1) Nutrient roots, whose sole function is the conveyance of food material to the rest of the plant. The central bundle, which consists chiefly or exclusively of conducting elements, is surrounded by a comparatively insignificant cortical parenchyme, which may entirely disappear. (2) Firm attachment roots. These do not store up food material, are not contractile, and the conveyance of food-material is so unimportant that their sole or chief function may be regarded as the fixing of the plant to the substratum. They are characterised by the large development of stereome and one characteristic of the epiphytic Bromeliaceæ, Araceæ, Cyclanthææ, and of the terrestrial Bromeliaceæ, Gramineæ, and Palmææ. (3). Contractile roots (*Zugwurzeln*). These contain few or no stereids, while the thin-walled parenchyme is relatively well developed and permanent. Contractile roots may or may not be also organs of storage. (4). Storage roots. The structure of these roots agrees with that of other organs used for the same purpose; they consist chiefly of a permanent parenchyme filled with food-material, and may be swollen into the form of a tuber.

The roots of herbaceous plants may live only for a single year, or for of several years, or may have an apparently perennial existence. They may be produced only at one or two different periods in the same year. The same species may have more than one kind of root, and these may or may not pass into one another by insensible gradations.—*Journ. Royal Micro. Society and Ber. Deutsch. Bot. Gesell.*)

The manufacture of Leather.

Extract from a lecture by Prof. Henry R. Proctor, printed in the Journal of the Society of Arts.

The vegetable tannins form a large class of bodies varying very considerably in their chemical structure, but having in common the properties of precipitating gelatine from its solution, of forming dark-coloured compounds with ferric salts, and converting skin into leather. The function of tannins in plant life is not very clear. They are widely distributed through almost all classes of flowering plants, and occur at times in almost all parts of the plants, but perhaps most abundantly in fruits and barks. They are also very frequent in galls, caused by the attacks of insects and aphides, though they are sometimes credited with being deterrents of insects. A curious point is that even in the same plant different tannins may exist in different parts; thus the

tannin of the bark, the wood, the acorns, and the galls of the oak is distinctly different, though it is quite possible that all of them are mixtures; since, from their uncrystallisable character, any very accurate separation of the different tannins has so far proved impossible, and it is by no means certain that the number of really distinct tannins is a large one.

Besides the chemical reactions which I have stated to be common to the whole class of tannins, there are certain relations in chemical structure which must be briefly mentioned. All tannins belong to the great class of "aromatic compounds," which also includes most of the coal-tar-colours, and many of the most important products of manufacturing organic chemistry. The peculiarity of this class is that all the bodies belonging to it contain a group of six carbon atoms, usually supposed to be linked together in a ring form, which remains unbroken through all the combinations into which it enters. The simplest of these compounds is ordinary coal-tar benzene, a colourless volatile liquid, the molecules of which consist merely of the six-carbon ring combined with six atoms of hydrogen. Closely allied to this is phenol or pure "carbolic acid," which differs only from benzene in having an-O-H group substituted for one of the hydrogens. Other phenols exist containing two-O-H groups replacing hydrogen (dihydric phenols), and three-O-H groups (trihydric phenols). If we represent the benzene ring, as is usual, by a hexagon, of which the angles correspond to the carbon atoms, it is obvious that so soon as we have more than one substituted hydrogen there will be a possibility of different compounds identical in the number and kind of their atoms, but varying as the substituted groups occupy respectively the 1-2, 1-3, 1-4 positions, and so on. Such bodies actually exist, and are known as "isomeric." Thus there are, as might be predicted, three different dihydric, and three trihydric phenols. From each of these bodies organic acids may be derived by substituting the C O. O H group for yet another of the hydrogens. All the natural tannins contain either the dihydric phenol, catechol, or its corresponding acid, protocatechuic acid; or the trihydric phenol, pyrogallol, or its corresponding acid, gallic acid. No natural tannins seem to be formed from any of the isomeric members of the phenol class, though some, in addition to catechol, contain the trihydric phenol, phloroglucol; but it is stated that bodies having many of the properties of tannins have been artificially formed from other phenols.

The tannins therefore fall naturally into two great classes those derived from protocatechuic acid, and which yield catechol on dry distillation, and which may therefore be called the catechol tannins, and those from gallic acid, which yield pyrogallol on heating, and may similarly be called pyrogallol tannins. It is possible, though not certain, that tannins may exist which contain both these groups at once, and it is certain that there are catechol-

phloroglucol tannins, containing both the dihydric phenol, catechol, and the trihydric phenol, phloroglucol. This difference in constitution corresponds to a marked difference in properties. The catechol tannins generally give green-blacks with ferric salts (though infusions of some of the mimosas give violet-blacks, probably from the presence of colouring matters). Their infusions are precipitated by excess of bromine water, and, employed in tanning, or boiled with acids, or even alone, they give dark-coloured, and generally red and difficultly soluble products, which are deposited on the leather, as in the characteristic case of the hemlock bark of America. Similar red products of oxidation or dehydration are produced by exposure to the sun, so that pale leathers from these tannins, such as East Indian sheep and goats skins, tanned with "turwar" bark (*cassia auriculata*), are rapidly darkened by light, and may even be printed under a photographic negative. The catechol-phloroglucol tannins, such as those of cutch and gambier, behave in this respect very similarly to the ordinary catechol tannins. Pyrogallol tannins, on the other hand, give blue-blacks with ferric salts, and no precipitate with bromine water, and usually a pale precipitate of ellagic acid with acids, and on the surface of leather, constituting what the tanners term "bloom." This deposit is not due to the decomposition of gallo-tannic acid, the "pure tannin" of the shops, and the most important of the pyrogallol tannins, but to the presence, in larger or smaller proportion, of an allied tannin, ellagitannic acid, of which the constitution is very imperfectly understood. Gallo-tannic acid itself gives no "bloom," though ellagic acid is easily formed from it by the action of dehydrating agents. Divi-divi, myrobolans, sumach, and galls are good instances of pyrogallol tanning materials, the proportion of ellagitannic acid present being largest in the first and smallest in the last. The only tannin of which the structure is approximately understood is gallotannic acid, which was proved by Schiff to be a digallic acid, or acid anhydride of gallic acid; but even in this case it has been lately shown that Schiff's synthetic digallic acid is not absolutely identical with the natural product.

The precipitate which is formed when gelatine and tannin solutions are mixed is not of constant composition, but varies considerably, according to whether the gelatine or the tannin have been in excess at the moment of combination. Its composition is also altered by washing with hot water, so that it has not the characteristics of a definite chemical compound, but suggests rather the result of a chemical equilibrium, such as has been described in connection with the pickling process, though no explanation on these lines has yet been attempted. It is possible that there may be more than one compound formed between gelatine and the tannins, and that the observed irregularities of composition are due to the presence of the two compounds in varying proportions.

The popular idea that modern tanning is done with 'chemicals' as opposed to vegetable tanning materials is altogether erroneous. The great changes which have taken place in tanning methods since the days of our forefathers have been in the first instance mechanical; much work which was formerly done by hand is now accomplished by steam power. In the second place, advantage has been taken of the vegetable products of other lands, often cheaper and richer in tanning matter than our indigenous oak bark, and, therefore, enabling leather to be more quickly produced by the use of stronger infusions, and still more by their systematic change and renewal. The best leathers of the present are probably not only cheaper, but actually better than those of earlier date, and I do not believe that those who are willing to pay a reasonable price for a good material, were ever better shod than at present; though it must be admitted on the other hand, that at a low enough price worse rubbish can be obtained than our forefathers knew how to make, and that, at the same time, it is so well got up that no one but an expert can judge by its appearance.

In older times, oak bark was practically the only tanning material used in England, and its great virtue was that leathers made with it alone were applicable to a great variety of purposes, and that with an honest tannage it was hardly possible to produce other than a fair wearing quality of leather. Among the host of materials now at the disposal of the tanner, there is scarcely one with the same wide range of applicability, and, therefore, much more skill is required in their proper use and combination, while some of them lend themselves readily to the production of qualities, such as weight and colour, which are profitable to the tanner, while offering no guarantee of wear to the purchaser. One of the most important of modern materials, though now in its turn somewhat eclipsed by later introduction is valonia, the large acorn of an evergreen oak of Asia Minor and Greece, which contains about three times as much tannin as the strongest oak bark, but of a somewhat different character, giving a harder and heavier leather owing to the presence of a larger proportion of ellagitannic acid, which yields much of the white deposit known as "bloom." Another exotic material, of somewhat the same character, but yielding rather a lighter and more porous leather, is myrobalans, the dried fruit of a large Indian tree, *Terminalia chebula*. Akin to this in the character of its tannin, but yielding still lighter coloured, softer, and lighter-weighting leather is the sumach, the leaf of the *Rhus coriaria* of Sicily, which is used mainly for soft and light leathers such as morocco, in which resistance to water is of small importance. The tannin of sumach is nearly pure gallotannic acid, allied with a colouring matter giving yellow dyes with alum and tin mordants, and which has been shown by Perkin to have interesting chemical relations to the tannin with which it is associated. I must also

mention *divi-divi* and *algarobilla*, the pods of South American trees closely allied to log wood, which are amongst the richest of natural tanning materials, *algarobilla* being perhaps six times as strong as oak barks. The curious name *divi-divi* has a legendary connection with David Davis, who is said to have been the captain of the ship in which it was first imported, but the history of the word *algarobilla* is somewhat more interesting. The Arabic name *al kharrouba* (the locust bean) was introduced into Spain by the Moors and under the Spanish form, *algaroba* is the general name in Spanish-speaking countries for a bean-like pod, of which *algarobilla* is of course the diminutive. All these materials contain tannins mainly of the pyrogallol group, and to them one more may be added which is of constantly increasing importance. The wood of the oak, like most other parts of the tree, contains tannin, yet in very small proportion, say only one-fourth as much as in a good oak bark. It is therefore in itself a practically valueless tannin material, but one to be had in enormous quantities, especially in the great oak forest districts of Slavonia as a waste product from the timber industry. It is, therefore, converted into an extract of at least ten times the tanning strength of the original material. The timber is first reduced to shavings about one-eighth of an inch thick by the action of a machine, of which the essential part is a drum fitted with powerful plane blades on its circumference against which the timber is pressed, the shavings are carried by elevators and chain-conveyors to a series of large vats fitted with steam pipes for heating, and by pumping from one to another of these, tolerably strong liquors are obtained, but of a colour too dark to meet the somewhat exacting requirements of the tanner and his customers, both of whom are ready to sacrifice a good deal of real quality and cheapness to the appearance of boot soles which the first day's wear will irretrievably disfigure! The liquors, therefore, after settling and cooling to a temperature of about blood-heat are treated on precisely the same principle as the cook uses to brighten her jellies, but in the place of white of egg, the cheaper substitute of dried blood or blood albumen is employed. This is dissolved in water and well mixed with the liquor by revolving stirrers, and the temperature is then raised till the albumen coagulates and carries down with it a good deal of the colour and suspended impurities, together with a certain portion of the tannin. The liquor is now settled and the muddy portion filter-pressed; the clear infusion thus obtained is run to vacuum pans and concentrated at a low temperature to an extract of about the consistency of treacle, and containing about 25 to 30 per cent. of tanning matter. Another kindred industry is the manufacture of extracts from the wood of the Spanish chestnut, principally carried on in the south of France where this tree is abundant. The chestnut contains more tannin than oak wood, and the manufacture of the

extract is carried on in a similar manner. The product differs but little from oak wood in its tanning properties, and is so like it in appearance and chemical characteristics that it is frequently substituted by unscrupulous dealers.

So far I have spoken only of tannins belonging more or less definitely to the pyrogallol group. I must now mention some of the derivatives of catechol. Of indigenous European representatives of this class the barks of the larch and the spruce fir are the most important representatives, larch bark being used in Scotland for tanning sheep skins, while spruce bark is one of the most important materials in eastern Germany and Austria. Curiously, spruce bark is not used in Scotland, and larch bark but little on the Continent, while what becomes of the enormous quantities of spruce bark which must be produced in the Scandinavian forests I have never been able to discover. Both barks make leather of a pale colour, and, for many purposes, of excellent quality.

Of much greater importance than the European pine barks is that of the American hemlock spruce (*Tsuga* or *Abies Canadensis*) which is one of the principal tanning materials of North America, and which is used not only for the red hemlock sole leather, but either alone or in combination with other tans or with alum for a large proportion of the dressing leather which is exported to Europe. Another tannin of the group in the form of extract under various names which is gradually finding its way into English yards, is from the bark of various trees of the mangrove family, and especially from *Ceriops Candolleana* which is very abundant in the swampy creeks of tropical Africa and the East Indies. Quebracho, the very hard and heavy wood of a tree from the Argentine, belongs to the same class of tannins; and canaigre, the tuberos root of a large dock, is also a catechol tannin, though different in many respects from those already noted. The various mimosas and acacias also belong to the catechol group.

The modern tanning process consists in submitting the hides or skins previously prepared by the methods of liming and bating which have been already described, to infusions of tanning materials, which are gradually increased in concentration as the process advances, and of which the strength is frequently maintained in the later stages by layers of the ground tanning material dusted in between the leather. In earlier days, this dusting was the principal means of bringing the tanning matter in contact with the skins; and much of the increased rapidity of modern processes is due to the use of strong infusions which keep up a better supply of the tannin. The making of such strong liquors without wasteful expenditure of the material is therefore an important branch of the tanner's art. Much of the success of the operation depends on the suitable pulverisation of

the material in the first instance. The tannins are formed in cells with cellulose or woody walls through which, from their uncrystallisable character, they diffuse very slowly, and it is therefore important that cells should be as much broken up as possible in grinding and crushing. On the other hand in dealing with large quantities, it is found that too finely powdered material, when it is wet, presses together into a mass so solid that the liquor will not percolate through it, and it is necessary that it should be sufficiently coarse, or in such a condition that this does not take place. The best way of accomplishing this is dependent on the nature of particular material. With woods it is found that shavings cut transversely to the grain, so as to divide the sap tubes into short lengths, are very satisfactory; barks are best ground in such a way as to rag them as completely as possible without the production of too much fine dust; while many fruits, such as myrobalans and valonia, are better crushed into flakes rather than actually ground. The extraction takes place in large vats or leaches, provided with a latticed or perforated 'false bottom' to allow of drainage; and in the best yards these are generally connected in series of 6-10 vats in such a way that the liquor from the bottom of the weakest and nearly-exhausted vat flows by gravitation on to the top of the next stronger, forcing its liquor down through the false bottom and up a tube on to the top of the next and so on. This method greatly diminishes the labour of pumping and makes it possible to secure a much more constant and systematic change of liquor, which is of great importance, since the dissolved tannin in the material will only diffuse out into liquor weaker than itself, and no length of mere soaking in liquors which are not sufficiently changed will accomplish satisfactory exhaustion. The use of heat is also of great service. Hot liquors not merely extract more rapidly, but bring portions of the tannin into solution which cannot be extracted in the cold. On the other hand, the colour of these "difficultly soluble tannins" is generally darker and redder than that of the more soluble part, so that in many cases it is a question of judgment how much tannin it is worth to sacrifice for the sake of improved colour. It has been shown by the work of Parker, myself, and others, that each tanning material has an *optimum* temperature of extraction at which more tannin can be removed than at any other, but this is sometimes too high for the best results in colour. As a general rule, however, considerably increased quantities of tannin can be extracted by the use of heat, say up to 60°C, on the weaker and nearly-exhausted leaches without any commensurate injury to colour.

VII. TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

NOVEMBER 3RD, 1899.

EAST INDIAN TEAK.—The deliveries up to date this year amount to 14,972 loads against 15,572 loads in the same period of 1898. In the past October they were 880 loads, and in October, 1898, 1,420 loads. Prices for the wood landed here are hardly so good as in the previous month, but the dulness is superficial. Cargoes immediately available continue to be sold to the Continent at the extremest level of previous rates, and the supply is about exhausted. Prospects for the future continue to be veiled in some uncertainty, the problems of probable demand and supply offering many difficulties for solution.

ROSEWOOD.—**EAST INDIA**—is in steady but less active demand.

SATINWOOD.—**EAST INDIA**—remains dull, and stocks ample.

EBONY.—**EAST INDIA**—has been more enquired for, and small shipments in good logs would command fair prices.

PRICE CURRENT.

Indian Teak, per load	...	£11	to £16 10s.
Rosewood	„ ton	£9	to £11
Satinwood	„ foot(superficial)	5d.	to 12d.
Ebony	„ ton	£6	to £8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1ST NOVEMBER, 1899.

TEAK.—The landings in the docks in London during October consisted of two sailer cargoes, and some small parcels by steamer, aggregating altogether 2,087 loads of logs and 488 loads of planks. The month's deliveries from the docks to consumers consisted of 869 loads of logs and 506 loads of planks. The dock stocks at date analyse as follows :—

7,481	loads of logs	as against	8,473	loads at same date last year.
2,731	„ plans	„	3,511	„ „ „
8	„ blocks	„	40	„ „ „

Total 10,170 loads „ 11,988 loads.

The strengthening of the stock of logs is satisfactory, as small stocks in London tend to drive consumers to other markets, as shown by the comparatively small consumption of the month. Prices are without alteration, and this fact should serve to show shippers that this market will have to be more radically starved than has yet been the case, to justify any attempt to raise prices further. We shall continue to doubt if their outlets in the Eastern markets have assumed such increased scope as to make the starving of the European market an easy, even if it were a politic matter, and we are quite confident that any such action would not "pay" in the long run.

Business during the month has been for the most part good, but a little unsettled by the outbreak of war, which has caused a general hardening of freights, and some consequent uncertainty as to making forward contracts. The general trade of the country continues to hold so good that any little dislocation caused by political events is expected to be more than compensated for by the active development of settled trade in south Africa, which should be the result of the present conflict. /

MARKET RATES OF PRODUCE.

Tropical Agriculturist.

NOVEMBER 1ST. 1899

Cardamoms	per lb.	2s. 6d.	to	2s. 9d.
Oroton seeds	„ cwt	40s.	to	55s.
Outeh	„ „	28s.	to	35s.
Gum Arabic, Madras	„ „	23s.	to	35s.
„ Kino	„ „	65s.	to	75s.
India rubber, Assam	„ lb.	2s. 10½d.	to	3s. 2½d.
„ „ Burma	„ „	2s. 9d.	to	3s. 2d.
Myrabolams, Madras	„ cwt.	5s. 6d.	to	6s.
„ „ Bombay	„ „	4s. 9d.	to	9s. 6d.
„ „ Jubbulpur	„ „	4s. 3d.	to	7s.
„ „ Bengal	„ „	4s. 6d.	to	6s.
Nux Vomica, Madras	„ cwt.	7s.	to	10s.
Oil, Lemongrass	„ lb.	2½d.	to	2½d.
Sandalwood, Logs	„ ton	£20	to	£50.
„ „ Chips	„ „	£4	to	£8.
Sapanwood, Madras	„ „	£4	to	£5.
Seedlac	„ cwt.	55s.	to	60s.
Tamarinds, Madras	„ „	7s. 6d.	to	8s. 6d.
„ „ Calcutta	„ „	15s. 6d.	to	16s.

NOTES TAKEN ON EXCURSIONS TO ~~WESSEL~~
NEAR GIESSEN.
6th to 8th May 1893.

NOTES ON THE FORESTS NEAR LAUBACH IN OBER- HESSE.

The forests in the vicinity of Laubach are the property, some of the State, some of villages, and one, of very considerable extent, is the property of a private individual, the Graf von Laubach. All are under systematic management, the two former classes under the direction of officers appointed by the State, and the last of officers who have received the same technical education as Government Forest Officers, and are treated the same in respect of pay, leave, and pension. In the case of some of the village forests the produce is sufficient to cover all municipal expenses, and the inhabitants have to pay no local taxes and no school fees.

The main point of difference between the "Frankfurter Stadtwald," or Town Forest of Frankfurt and the forests near Laubach is in the soil, here a rich loam formed by the disintegration of the ~~granite~~ ^{gneiss} which underlies the district, and more favourable to the growth of oak. It is found that though difficult to reproduce naturally, the oak here is not so liable to be suppressed by the beech; that once safe up to the 30th year it requires no further protection against the beech.

As mentioned in my notes on the Town Forest of Frankfurt, the oak does not produce the same class of timber when grown pure as when grown mixed with other species; it does not grow so straight, and throws out side branches which affect its value as timber. Beech has been found by experience its best associate, and opinions vary as to how the mixture may best be effected. There is no doubt that the best growth of oak is produced where the trees are of nearly equal age and the two species are intermixed by single trees; but such a mixture, under ordinary conditions, involves a great deal of care—more than is advisable in practical forestry—to see that the oak, which during youth is slower growing than the beech, is not suppressed by the latter. In the "Frankfurter Stadtwald," the oak is given a start of 30 or 40 years, when the beech is brought in as an under-storey. Here, where the difference in the rate of growth between the two species, owing to the constituents of the soil, is, if any, very small, the plan adopted for producing the mixture is to bring in the oak by sowing just before the preparatory stage of the regeneration felling, and to favour the oak in the cleanings and early thinnings.

The treatment is well illustrated in compartment 1 (d), "Senges," in the Communal forest of Laubach, situated towards the top of a slope facing east-north-east. The age of the wood is 40 to 50 years. It consists of beech with oak by single trees, and, here and there, groups of spruce. The ~~wood~~ is the result of natural regeneration under a shelter wood carried out in the usual manner. The oaks were introduced in the preparatory stage by sowing five years or so before a mast was expected. The spruce were brought in by planting in patches where beech regeneration was deficient. The oak had thus a start of the beech, and were also favoured in the cleanings and early thinnings. The result is a good specimen of a mixed wood: the oak strong and vigorous with crowns well up, the stems clear and straight. The spruce towers above both the oak and the beech. In another compartment near the above, there is a wood about 60 years old

of similar origin and character where the superiority of the oak is even more evident. And in another where the oak and beech are of the same age, the oak does not appear to have suffered in the struggle with the beech.

EXPERIMENTS TO ASCERTAIN THE EFFECT ON THE FOREST OF DIFFERENT DEGREES OF THINNING.

In order to obtain reliable statistics on this point it was resolved by the Association of German Foresters, which met about 10 years ago, to carry out a series of experiments on a uniform plan in different classes of forest throughout Germany. Sample areas varying in size from $\frac{1}{4}$ to 1 hectare were to be selected and thinnings made in them of varying intensity, the operations being conducted with the utmost care and detailed measurements made periodically.

Three degrees of thinning.—Thinnings are classed as :—

- I. "Light", where the dead and dying trees *only* are removed ;
- II. "Moderate", where the dead, dying, and *suppressed* trees are removed ; and
- III. "Heavy", where in addition to the dead, dying and suppressed, the *governed* trees also are removed, and which results in the cover being interrupted.

In the Communal forest of Laubach sample plots of $\frac{1}{4}$ hectare have been selected in beech and spruce woods. As a suitable area stocked with pure beech could not be found, three plots have been taken in "Senges" ; compartment 1 (b), in which there is a slight admixture of oak by single trees. The plots have been taken in the centre of the compartment, in a sheltered position, so as to be subject as little as possible to exceptional external influences. All details concerning position, nature and depth of soil, aspect, slope, species, degree of stocking, etc., are recorded in full on special forms. Thinnings are to be carried out every five years, and careful and detailed measurements made of the quantity taken out and that left.

To ensure the proper degree of thinning being applied in each case, the three plots are taken in hand together, and the first degree of thinning carried out in all ; that is, the dead and dying trees are removed. Then plot No. 1 is left out, and from the other two all the *suppressed* trees are taken out. Finally plots Nos. 1 and 2 are set aside, and out of the 3rd all the *governed* trees are removed.

The result of these experiments will be most interesting and instructive. The operations have, however, as yet extended over too short a period to enable any conclusions to be drawn, only one thinning, that of 1892, under the supervision of Professor Dr. Hess of Geissen University, having been made since the establishment of the sample areas in 1886.

Sample plots have likewise been selected in a pure spruce wood in "Gaulskopf," compartment 2 (a), in which experiments on exactly similar lines are being carried out. The wood in this case, which is 46 years old, originated by planting up fields in lines 1.75 metres apart, the plants in the lines .75 metres from each other. In each of the sample plots, both in the beech and spruce woods, 100 trees have been pruned to a height of seven metres as an experiment.

Eclaircies par le haut.—In the adjoining forest belonging to the Graf von Laubach similar experiments are being carried out in a beech wood. The area of the plots in this case is one hectare each. There are four plots, and in addition to the three degrees of thinning described above, a fourth method, that known in France as the “*eclaircies par le haut*,” is being tried. It consists in selecting a certain number of the finest dominant stems which are to be specially favoured. In the present case 1,400 such trees have been selected and marked, this being the number per hectare which it is considered desirable to have at the present age of wood,—60 years. All the other dominant trees which appear in any way to threaten these marked trees, or hinder their development, as also all the dead and dying trees, are removed in the thinnings, the governed and suppressed being left to protect the soil. The number of favoured trees will of course go on diminishing with the age of the wood, till at the end of the rotation only a portion of the present lot will form the final crop. The advantage claimed for this method is that from the very first the stems which form the final crop are selected and specially favoured, and have thus a better chance of developing into good trees than if the process were left to chance.

METHOD OF NATURAL REGENERATION UNDER A SHELTER WOOD BY COMPARTMENTS AS SEEN AT ALTENBUSECH AND ANNEROD.

Method shortly described.—The method has been described in my “Notes on the Town Forest of Frankfort.” It will only be necessary to recount the successive cuttings which bring the wood into the three stages of the operation :—

- I. “Preparatory,” which may be repeated several times, the object being (i) to bring the soil into the condition of a good germinating bed ; (ii) to strengthen the remaining wood ; and (iii) to stimulate seeding ;
- II. “Seeding,” made while the seed are still on the trees, or shortly after they have fallen, the remaining trees then forming the “shelter wood” ; and
- III. “Final”, which is done in several operations, even as many as seven or eight, the shelter wood being gradually removed according to the requirements of the young generation.

In these forests the whole operation extends over about 20 years.

Example of preparatory stage.—At “Hubertus brunnen”, compartment 54, is a sample plot of one hectare which is being carefully treated with the object of ascertaining experimentally what proportion of the “sectional area” ought to be cut out in the “preparatory” stage. The wood consists of beech 54 years old, with a little oak and hornbeam, described as being of middling growth, middling quality. In 1886 a detailed measurement was made of the trees, which were numbered, showing :—

Beech	643 trees with sectional area of	.	27,508 square metres.
Oak	68 „ „ „	.	4,312 „ „
Hornbeam	7 „ „ „	.	463 „ „
<hr/> Total			<hr/> 32,283 „ „

In the winter of 1886, after the above measurements had been made, the following were removed as a preparatory felling:—beech 171, oak 2 and hornbeam 3, with a total sectional area of 4.48 square metres. A second cutting was made in the winter of 1891, when the following were removed:—beech 77, oak 6 and hornbeam 4, with a total sectional area of 2.96 square metres. The total volume of timber, excluding root-wood, yielded in these cuttings was 9.965 cubic metres. There now remain on the plot 395 beech and 55 oak; total 450 trees, with an aggregate sectional area of 27.099 square metres.

The ground is in a good condition to receive the seed, the mineral soil being visible here and there through the dead-leaf covering, and grass beginning to appear in places as also patches of young seedlings. Advantage will be taken of the next mast year to carry out the "seeding" cutting.

Example of seeding stage.—Near Annerod is a compartment, a beech wood in which a seeding cutting was made in 1886. Two mast years have occurred since, one in 1888, the other in 1891. The area is fairly, though not densely stocked with growth which will be sufficient later on to cover the ground. Oak and ash have been planted in chiefly where young beech were thin. At one time the young crop is described as having been as "thick as corn in a field"; but for some reason a large proportion of the plants died off. The shelter wood appears to me to be a little too dense.

Example of final stage.—"Vorderster Seewald", compartment No. 18,—an oak and beech wood. The first cutting was made in 1876 when the wood was approximately 105 years old. The seed year occurred sooner than was expected, in 1877, and the area was stocked fairly well. Thus no seeding cutting was made, or rather the "seeding" stage was merged in the "preparatory". In 1879 the first cutting was made in the "final" stage, and since then six others have been made accompanying the development of the young crop. There are approximately 40 trees per hectare left as a shelter wood, all of which it is proposed to remove next winter. The ground is well stocked with young beech. Acorns had been dibbled in here and there, and a few Scotch pine have sprung up naturally. It will be noticed that the regeneration felling in the present instance will have occupied only 17 years.

In compartment No. 16, not far from the last, the last cutting in the final stage was made five years ago when the last shelter trees were removed. The area is densely stocked,—nothing better could be desired.

Objection to the method considered.—Objection is raised by the advocates of the system of clear-felling and planting to the time occupied in re-stocking an area by the method of natural regeneration; but it must be borne in mind that the interval between the first preparatory felling and the last felling in the final stage is not lost; that during all this time not only is the young generation coming on, but the shelter trees are putting on increased growth, every cubic foot now put on raising the value of the timber. From measurements made in a compartment in which regeneration fellings were commenced 25 years ago and completed five years since, it would appear that whereas the annual increment before the preparatory fellings were made was 1.2 per cent. of the growing crop, the increment the first year after was 1.7 per cent., and the third year actually 2.5 per cent. Of course this increased rate is not maintained for very long.

FORESTS OF THE SPESSART, BAVARIA.

10th to 20th May 1893.

There are in the Spessart, besides State and Communal forests, extensive private forests, as also forests belonging to monasteries and other religious institutions. The State and Communal forests are divided into 12 ranges, each under an officer called a "Forstmeister" corresponding to an "Oberförster" in other parts of Germany, with the same duties and the same responsibilities. Taking the three principal ranges in the southern portion of the Spessart the areas of which are :—

Rothenbuch	.	.	.	.	.	3,487 hectares.
Nohrbrunn	.	.	.	.	.	5,394 "
Lohr west	.	.	.	.	.	2,870 "
TOTAL						11,551 "

the average area of an executive charge would be 3,850 hectares; say 9,600 acres or 15 square miles. The larger ranges are divided into two sub-ranges, one of which is under the immediate control of the Forstmeister, and the other of a "Forst Accessor" who is subordinate to the Forstmeister. Ranges are divided into a varying number of districts, and districts into compartments, which may be sub-divided into sub-compartments. Districts are denoted by Roman, compartments by Arabic numerals, and sub-compartments by a small letter. The compartments are also all named, and are better known by their names than by their number. Each district has here also a separate numbering for its compartments instead of the numbering running right through the range. Where not bounded by roads, etc., compartments are marked by cleared lines 3 metres wide, and sub-compartments by lines 1 metre wide which, however, are not, always clear.

The rights of the villages of the Spessart have an important bearing on the management of the forests. Indeed at one time the unregulated exercise of some of them, such as grazing and the removal of litter, seriously affected the well-being of the forests. Grazing has practically ceased with the recognition of the advantages of stall-feeding and the practice of growing fodder crops; and the removal of litter is under regulation by the State. The rights now exercised are :—

- (i) *Right to litter.*—Forest litter is an absolute necessity to many of the villages, and the right cannot, therefore, be commuted. It has accordingly been regulated :—A regular plan is drawn up every six years. Areas are assigned to the villages, and two days are fixed in autumn (before the leaves fall) and two days in spring (before the leaves open) on which alone the litter may be removed. Superintendence is thus rendered easy. No litter is allowed to be removed from woods which have not passed through half their rotation, or are within six years of being regenerated; and eight years at least must elapse before litter can be removed from the same area again.
- (ii) *Right to dead and dry wood.*—Villages have the right to all dead wood up to a diameter of 9 centimetres. The right

may be exercised on Tuesday and Fridays only from August to April. In return for these restrictions the State has agreed to make no thinnings in woods of broad-leaved trees till after the age of 60 years, and in coniferous woods till after the age of 30 years. This favours the production of dead wood, but has an injurious effect on the growth. The people have also the right to branch wood up to a diameter of 5 centimetres which must be removed within three weeks of the thinning or cutting, as the case may be, of which due notice is given to the people.

(iii) *Right to pannage* may be exercised by villages of the Spessart in years when there is no heavy mast. On the occurrence of a heavy mast the right is leased out, acorns being collected as payment.

(iv) *Right to feed gress*, generally in some of the lower-lying portions of the forest, is a right of no importance.

The climate varies with the elevation, but it may be described as generally rough. Snow falls in considerable quantities on the upper hills causing much damage to the trees, especially to the Scotch pine. Late frosts also occur, injuring not only the young leaves but also the flowers; and this is no doubt the cause of the comparative scarcity of good seed years. As a consequence of the liability of the tract to late frosts the regeneration of frost-tender species, such as the beech, has to be carried out under a shelter wood.

FOREST GROWTH.

Considering the unfavourable conditions of soil and climate the forest growth of the Spessart must be admitted to be wonderfully good; and this is due chiefly to the fact that the tract of country has from time immemorial been under forest. The productivity of the soil in parts has no doubt deteriorated in consequence of the excessive removal of litter, but with the regulation of the practice the fear of further depreciation from this cause may be said to be entirely removed.

By far the most prevalent species is the beech. It occurs frequently as a pure wood, but it is rarely quite pure, there being usually an admixture of oak by single trees. Besides the admixtures with oak presently to be described, it frequently forms a lower storey under the Scotch pine (compartment Vingart, Waldaschaff Range). It is also found mixed with the Scotch pine by single trees (compartment Hortig, Rothenbuch Range).

The beech is easily reproduced naturally, even in the highest parts of the Spessart, and, indeed, springs up spontaneously almost everywhere. It is liable, however, while young, to be nipped by late frosts. Owing to its more vigorous growth it has to be kept back with a tight hand wherever it occurs in combination with the oak. Heavy beech masts occur on an average only once in 20 years, but there are partial masts every six or seven years.

The principal species, however, as regards its importance is the oak, here of the sessile-flowered variety. The Spessart Oak. has long been famous for its magnificent oak timber; and though the conditions of the locality are not so favourable for the oak as for the beech, its capability in the way of producing large oak timber may be seen from existing specimens in the older woods, for instance in compartment Eichhall of the Rohrburn Range, where trees of some 500 years of age attain a height of over 40 metres with a diameter of over 130 centimetres.

It is a curious fact, and one which of course has had an important influence, as will be seen later on, in fixing the annual yield, that there are no oaks between the ages of 100 and 240 years. There are all ages up to 100, then there is a gap of 140 years, and trees from 240 to about 500 years old.

Its mode of occurrence. The oak occurs—

(a) pure or nearly pure in—

- (i) the old pasture forests, in the condition of open wood;
- (ii) and (iii) other woods, old and young, forming a complete or nearly complete cover;

(b) in mixed woods as—

- (i) old growth mixed by single trees with old beech;
- (ii) old standards among younger beech;
- (iii) middle-aged woods forming an upper storey above young beech;
- (iv) pole wood mixed by single trees with equal aged beech;
- (v) pole wood and younger growth mixed with beech of about equal age by groups or strips.

(c) PURE OR NEARLY PURE OAK WOODS.

(i) *Pasture forests.*

These open park-like forests of isolated, low-crowned, spreading oaks were at one time of very large extent in the Spessart. They are now chiefly represented by some areas near the village of Rohrburn and in compartment Bomigrain, Rothenbuch Range. They were in former times the pasture-grounds of the cattle belonging to the villages of the Spessart which, being continually grazed over, had little chance of regenerating themselves. After the "Thirty Years' War," when the cattle were killed or driven away in large numbers and grazing practically came to an end, many of these pasture forests regenerated themselves; and it is believed that most of the older oak woods, as for instance compartment Eichhall in the Rohrburn Range, were thus originated.

(ii) *Old oak wood with complete or nearly complete cover.*

Such woods are represented by compartment Eichhall just men-

tioned. There are 400 hectares in the vicinity stocked with a somewhat open wood 243 years old. There is an undergrowth of beech, natural on 100 hectares, planted on the rest. The old wood has, however, grown up pure, the underwood having been brought in too late to have much effect on the oak which are not nearly so good as if they had been grown mixed with the beech from the start. A valuation survey made on the 15th May 1893 in a portion of this compartment (*see* Valuation Survey No. 7) gave the following results per hectare :—

Age	243 years.
Number of trees	241
Sectional area	39.4 square metres.
Mean height	27.5 metres.
Volume of timber	563 cubic metres.
" " fire-wood	33.8 " "
Total Volume	597.2 " "

It is estimated that there are 72,000 old oaks on these 400 hectares, giving an average of 180 per hectare.

(iii) *Pole and younger oak woods.*

There is a good deal of pure oak in this stage. Near compartment Reisig, for instance, in the Rohrbrun Range, there are 240 hectares of pure oak wood, now in its 32nd year, average height 6—7 metres. This was formerly an old pasture forest in which acorns were dibbled in, the old trees being gradually removed. Some natural beech has sprung up among the oak. It is proposed to underplant with beech at the age of 40 years or so when the cover gets thin, and thus convert it into a double-storeyed forest of oak and beech, as represented by compartment Weisserstein of the Rothenbuch Range described later on.

(b) MIXED WOODS.

(i) *Old oaks mixed by single trees with old beech.*

In compartments Metzger and Krone in the Rothenbuch Range is a magnificent old wood of this class aggregating 46 hectares. The trees are some 400 years old. Some of the oaks are over 40 metres high with clear *boles* of 20 metres and more. In 1888 there were 677 old oaks in the 46 hectares, that is, nearly 15 per hectare. It is estimated that each tree contains 7.7 cubic metres solid (10 steros) of timber and fuel. This would give—

the volume of oak per hectare	115.5 cubic metres.
" " beech " "	231.0 " "
Total volume	346.5 " "

It is estimated that the oak would yield :—

- 40 per cent. of timber selling at 100 marks per cubic metre,
- 26 " " of large split wood at 20 " " "
- 34 " " of fuel at 3 marks,
- and the beech 80 per cent. of timber selling at 20 marks,
- and fuel 70 per cent. at 5 marks per cubic metre.

which would make the value of the oak and beech at present standing on this area 4,622 and 1,900 marks respectively per hectare, or a total of 6,522 marks. These old trees are only deteriorating, and if financial and sylvicultural considerations only had been taken into account, they would have been taken out long ago, but they have been left for economical reasons which will be explained later on.

At Züber in the Rothenbuch Range is another wood of the same class. The oak are 375 years old and the beech 145. The height of an average oak was found to be 37.2 metres; the beech are a little less. There is more increment here and less deterioration than in the last case.

(ii) *Old oak standards over young beech.*

This class of wood is very common and is especially noticeable all along the Rothenbuch Valley where the old oak standards are seen towering over the younger beech which close round them completely and cover the ground thoroughly.

In Urwald are some scattered old oak mother trees 400 to 500 years old, surrounded by younger oaks 240 to 260 years old which they have produced, and beech of about the same age, with an undergrowth of beech in the more open parts.

Many of these old trees are found to be unsound in the centre (due in almost all cases to the *Telephora perdris*) which accounts for the small percentage of timber yielded (40 per cent.).

(iii) *Middle-aged oak as an upper storey above young beech.*

A typical example of this class of wood is an area of 23 hectares in Compartment Weisserstein of the Rothenbuch Range, stocked with self-sown oak 100 years old and an undergrowth of beech raised between 1845 and 1854 by sowing and planting after a heavy thinning of oak.

The following thinnings have been carried out in this compartment:—

Up to 1884	3,420 stems taken out.
Between 1884 and 1887	305 " " "
" 1887 and 1890	490 " " "

Total . 4,215 stems, = 3,240 cubic metres.

or 154 cubic metres per hectare.

A valuation survey made on the 12th May last gave the following results per hectare:—

Age	100 years.
Number of trees (oak)	612
Sectional area	30.8 square metres.
Mean height	24.0 metres.
Volume of timber	357.6 cubic metres.
" fuel	28.6 " "

	Total	386.2 " "
Add thinnings		154 " "

GRAND TOTAL 540.6 or 54 cubic metres,
annual increment per hectare.

The undergrowth of beech averaged 6 metres in height, with an average diameter of 8 centimetres. There are about 5,000 stems per hectare.

In the vicinity of Weisserstein there are 280 hectares of oak 50 to 100 years old.

(iv) *Oak pole wood mixed by single trees with beech of about equal age.*

Woods of this class, as represented by Compartments Sülzhöh and Blaustain (a), are not now very plentiful in the Spessart. Owing to the greater vigour of the beech it is liable to suppress the oak, and it has therefore to be constantly cut back. And, although it is in such mixed woods that the oak attains its best growth, their tending makes too great a demand on the time and attention of the forester. They are therefore being dropped in favour of mixtures by groups which will presently be described.

The oak in such mixtures grows up very lanky, and it is found that when the beech around which threaten them are topped or removed, the oak are subject to much damage from the snow. The plan has recently been tried in the Waldaschaff Range, and the Forstmeister of Rothenbuch thinks of adopting it in his, of "ringing" instead of topping or removing the surrounding beech, which, dying gradually, give the oak some support till they are able to act alone.

(v.) *Oak pole wood and younger growth mixed with beech of about equal age by groups of various sizes or by strips.*

This system of producing mixed woods was introduced about 30 years ago in order to facilitate the favouring of the oak. Rides are cleared round the oak patches to prevent them being too much overshadowed by the surrounding beech, which is invariably taller of the same age. At first the patches were small (Compartments Schneusse and Blaustain (b) Rothenbuch Range), and not much attention appears to have been paid to the quality of the soil assigned to the oak. The labour of cutting rides is proportionally greater the smaller the patch, in the case of those of very small extent the edge beech having also to be topped. The next advance was to cultivate the oak and beech in alternate long strips (Compartments Schwarzbuch, (c), Rothenbuch Range, and Querbuch, Lohr West Range) allotting the best soil to the oak. But as the soil changes from place to place in these long strips, the oak had not always all the best soil. This plan was dropped in favour of the present one of selecting areas of one-half up to several hectares in extent on the best soil (Compartments Lindenbuch and Stampfmühle, Rothenbuch Range) and dibbling in acorns, the rest of the area being naturally regenerated with beech, conifers being planted in where the stocking is deficient. The quality of the soil is indicated by the height growth of the beech; the better the soil, the taller the trees.

The Scotch pine is not indigenous in the Spessart. It appears to have been introduced more than a century ago, and is now very widely distributed. It is employed on lands which have been impoverished by excessive removal of litter with the view of improving the soil for the Scotch pine.

reintroduction of the oak and beech. It can scarcely be said to thrive here and is very much liable to injury from snow. It rarely occurs pure, being generally underplanted with beech.

The spruce has lately been coming into favour and is much employed for filling up blanks or deficiently-stocked areas in beech natural regeneration. It occurs as a pure wood 85 years old in Compartment Schwarzbuch, but such pure woods are rare. It is more common in combination with the beech; and in the Waldaschaff Range it occurs in combination with the larch.

The only other species worth mentioning are the larch, the silver fir and the Weymouth pine. The first was planted in combination with the spruce on the outskirts of the forest where the soil had become deteriorated by the removal of litter. It appears to be doing well in the Waldaschaff Range, but in some parts of the Rothenbuch Range it has suffered considerably from cancer, caused probably by the *Peziza Willkimi*. It is, however, still largely planted in beech regeneration areas. The cultivation of the silver fir and Weymouth pine are as yet more or less experimental. Groups of silver fir planted in among the young beech in Compartment Schwarzbuch are doing excellently, and it is probable that this species will come more largely into use in the Spessart, the conditions being apparently suitable as shown by the rapid growth of one or two trees in "Forst Garten". The Weymouth pine has scarcely been given a fair chance: all the older trees seen—notably near Compartment Querbuch in the Lohr West Range—have been grown too open and have developed large side branches. It is liable to the attacks of deer and has to be smeared with tar and grease as a protection.

METHOD OF TREATMENT.

The aim of the management of the State forests of the Spessart may be described in a few words to be the production of the greatest quantity of large timber, principally oak, to meet the requirements of large industries which have sprung up all round the Spessart. In other words, the exploitability of the forests is qualitative. The Bavarian Government, recognising that the State alone is capable of producing large timber, has set itself the task of satisfying the wants of the country in that respect, without heed, one might almost say to the revenue, rate of interest and rent yielded by the forests; and, indeed, to ensure the yield being steady, it is even prepared to make great sacrifices from a financial point of view. For instance, the old trees in Metzger and Krone and similar woods, being over-ripe, are putting on next to no increment, and the timber is, if anything, steadily deteriorating. By being left standing the Government are losing not only the interest on the present value of the wood, but also the value of the increment which the soil should produce. The reason is that there are no oak woods between the ages of 100 and 240 years; and if all the oak were cut out as they became mature, there would be a gap of 140 years during which the supply of oak would cease. In order to bridge over this gap the cutting out of these old oak has been spread over a period of 120 years, by which time the more advanced of the present young woods will be ripe.

The method of treatment has already been foreshadowed in the descriptions of the woods. All the hollows and where the soil is good is to be reserved for the oak, beech and conifers being grown in the rest. The patches of oak to be from half to several hectares in extent. Beech is regenerated naturally under a shelter wood in the usual way, by preparatory, seeding and final cuttings. Where introduced as an underwood it is usually planted as yearlings, being procured from spots in the surrounding woods where the soil is soft.

Oak is introduced by dibbling in acorns under a shelter-wood. The cover over-head is kept as dense as possible, so as to prevent beech coming up, till an oak-mast year, when a preparatory cutting is made. Any beech seedlings which may have come up are plucked up or cut away, and the acorns dibbled in. In Compartment Bomigrain six hectares were sown last year, 15 hectolitres of acorns being used per hectare, the work being done by 60 children in one day: a slanting cut was made in the ground and the acorns put in just under the turf. Occasionally, as in Compartment Küppel, Lohr West Range, oak is planted; but this method is thought not to give good results in the Spessart.

Other species are brought in by pit-planting in the ordinary way, generally in places where beech regeneration is deficient or where the removal of the mother trees causes blanks.

Under "rights to dead and dry wood" it was mentioned that no thinnings are made in woods of broad-leaved trees till after the age of 60 years and in coniferous woods till after the age of 30 years; but beech may always be topped or cut out where it threatens the oak, the larch or any other species which may have to be favoured. A thinning may also be made with the view of underplanting before the ordinarily permissible time.

The restrictions as to the time of the thinnings makes the first thinning necessarily very heavy. In Compartment Schleiffe the first thinning in a beech wood 68 years old yielded 68½ cubic metres solid per hectare. The thinnings were formerly limited to cutting out the dead, dying and suppressed trees in a pure wood, and in mixed woods of oak and beech, to the removal also of such beech as threatened the oak; but within the last year or two, the thinnings partake more of the nature of what we in India call an "improvement cutting," a sort of modified "éclaircies par le haut" described in my notes on the forests of Laubach.

In the patches of oak which it is now the aim of the management to produce it is expected that beech will appear naturally as an undergrowth. If not self-introduced, it is intended to under-plant with beech at the age of 40 years or so, the oak being previously thinned. The mixture will improve the growth of the oak, which, with a start of 40 years, is not likely to be out-stripped by the beech.

WORKING-PLANS.

There are one or two features in the organization which are peculiar

to Bavaria. The rotation is divided into periods of 24 years each, not, as elsewhere, 20 years; and the yield is calculated in '*steres*,' that is cubic metres stacked, instead of "*fest metrees*" (cubic metres solid).;

The rotation for pure oak woods and woods in which oak-forms more than 50 per cent. of the mixture is 300 years; for beech woods, or woods of beech and conifers, it is 120 years; for Scotch pine woods 96 years, and for spruce woods 72 years.

The working-plans are based on the system of dividing the forest into "periodic blocks" (*vide* notes under this head in my report on the Town Forest of Frankfort, and the State forest of Vierheim). A special feature, which has been alluded to before, is the spreading of the supply of mature oak over a period of 120 years to bridge over a gap in the age classes from 100 to 240 years. A special plan has been drawn up with this object. The 120 years (from 1888) have been divided into five periods of 24 years each. The table below shows the number of old oaks in the three ranges, Rothenbuch, Rohrbrun and Lohr West, and the number of trees sanctioned to be cut in each during the first period:—

Range.	Number of old oak in 1848	Number of trees sanctioned to be cut annually.	Annual yield of old oak in <i>steres</i> .
Rothenbuch	14,000	810	2,900
Rohrbrun	102,000	800	8,800
Lohr West	70,000	800	2,900
TOTAL .	186,000	1,410	14,600

It appears curious that when the rotation is divided into periods of 24 years, the age classes should be reckoned by periods of 30 years as has been done in the case of the Rothenbuch range which shows the following distribution of the age classes:—

I class	over 90 years	covering an area of 945 hectares.	
II "	61 to 90	" " "	687 "
III "	31 to 60	" " "	920 "
IV "	1 to 30	" " "	894 "
Total wooded area	.	3,446	"
Unproductive land	.	41	"
Total area of Range	.	3,487	"

YIELD AND FINANCIAL RESULTS.

The table below shows the annual yield of the three ranges mentioned

above fixed by the Working-Plan of 1888 :—

Range.	Area in hectares.	ANNUAL YIELD IN STERES.			Annual yield of old oak (see table, page 22) included in "final" yield.
		Final.	Inter-mediate	Total.	
Rothenbuch . . .	3,487	13,700	2,500	16,200	2,000 steres.
Rohrbrun . . .	5,394	33,000	5,500	38,500	3,800 "
Lohr West . . .	2,670	12,400	1,800	14,200	2,900 "
TOTAL .	11,551	59,100	9,800	69,020	14,600 "

The table below shows the financial results of the three ranges, taking an average of the last four years (1889 to 1892) :—

Range.	TOTAL ANNUAL			Net profit per hectare.
	Receipts	Charges.	Net profits.	
Rothenbuch	169,899	<i>Marks.</i> 50,932	118,967	<i>Marks.</i> 34
Rohrbrun	316,967	99,052	217,915	40
Lohr West	125,898	49,089	76,809	29
TOTAL .	612,764	199,073	413,691	Average. 36

VIERNHEIM STATE FOREST, HESSE-DARMSTADT.

5th to 8th June 1893.

VIERNHEIM STATE FOREST.

The Viernheim Statswald, or State forest, lies in the Grand Duchy of Hesse-Darmstadt in the alluvial plain between the Rhine and the old bed of the Neckar which now flows into the Rhine at Mannheim. The surface is nearly quite flat: some sand dunes rise up to a height of 20 metres above the general level. Its elevation is about 100 metres above sea-level. The soil is a sandy alluvium. The water level is a little below the surface; and it is owing to a constant underground flow of water close to the surface of the Odenwald to the Rhine that deep-rooted species like the oak and Scotch pine are able to thrive in such poor soil. On rising ground, where the moisture is some distance below the surface, the growth is not so good. The climate is dry and subject to a large range of temperature: great heat in summer and severe frost in winter. Owing to the severity of the frost the beech cannot be grown in the open, but has to be raised in nurseries under a shelter wood of Scotch pine. The chief species are oak and Scotch pine. Beech also occurs in considerable quantities. Of secondary importance are the lime and hornbeam. The rotation for the oak is 160 years and for the Scotch pine 120 years.

VIERNHEIM RANGE.

The area of this range is 1,881 hectares. It was originally very heavily burdened with forest rights, but these have been commuted by the State by an annual payment of 41,000 marks and an allowance of 10,000 cubic metres, stacked, of firewood, to the village of Viernheim, the dominant estate. An area of 919 hectares of very poor growth is absolutely closed, but grazing is exercised in, and dry wood removed from, the rest of the forest, except in portions temporarily closed for regeneration.

The age classes are distributed as follows, the first here being the oldest:—

	Oak.	Scotch Pine.
I. Over 120 years	39 hectares.	
II. 101 to 120 "	32 "	
III. 81 " 100 "	93 "	52 hectares.
IV. 61 " 80 "	178 "	89 "
V. 41 " 60 "	300 "	243 "
VI. 21 " 40 "	366 "	91 "
VII. 20 and under	182 "	116 "
TOTAL .	1,190 "	591 "

It was in Viernheim that as early as 1810 the system of combined with the raising of field crops, was first tried for the regeneration of areas of old oak and Scotch pine, imperfectly stocked, which

had become deteriorated from an unregulated system of selection fellings and excessive pasture. The trees were felled, the stumps cleared, and the area was leased out for cultivation for 2 to 6 years, rye, oats, and potatoes being the crops grown. Acorns and the seed of Scotch pine were also sown with the corn. This procedure, which may be called Method I, was in force till 1842, when a slight modification was made, which may be called Method II: the land was leased out for cultivation for a year or two, and acorns and the seed of Scotch pine were not sown till *later*. In 1847 the farming system was abandoned, and the operations were continued on Government account. At first shallow ploughing was considered sufficient, but in 1852 the system of deep trenching the area to a depth of 14 inches was introduced. Where Scotch pine was to be grown, only two crops were raised, potatoes and rye, and the seed sown broadcast; on land intended for the oak four crops were taken,—potatoes, then rye, again potatoes then rye, the acorns being dibbled in between the potatoes of the first crop. Up to 1868, 722 hectares had been planted up altogether, and the rent paid under the farming system and the proceeds from sales of crops raised on Government account not only covered all expenses of establishing the young forest, but left a considerable surplus besides. From 1848 to 1868 the surplus of receipts over outlay amounted to 130 marks per hectare. But after the Franco-German War the cost of labour increased so largely that the surplus gradually diminished, until in 1875 the cost of production actually exceeded the value of the field crops. A return was in consequence made to the system of leasing out the land, but the expense of regenerating the forest in combination with the raising of field crops is exceedingly heavy, amounting in the year 1885 to 141 marks per hectare. Altogether 1,614 hectares, out of a total of 1,881 in the Viernheim range, have thus been regenerated between the years 1810 and 1886. Since 1886 the system has been practically abolished and is only tried in exceptionally favourable localities. The present method is, as soon as the ground has been worked up, to sow oak in alternate lines and plant Scotch pine seedlings one year old in the intermediate lines. Potatoes are then sown in lines between the Scotch pine and the oak.

Scotch pine, where grown in combination with the oak, are only as nurses to the latter. About the sixth or seventh year they are pruned; when older topped, and finally removed, according to the requirements of the oak, about the age of 20 to 30 years. When the oak begins to thin out it is underplanted with beech. The treatment of the forest will be best understood from the following short descriptions and histories of some of the woods:—

Compartment Ameisenlacke 2-a.—Area 26·5 hectares. An oak wood 83 years old. Acorns were sown broadcast on the ground previously used for agriculture (Method I). About 30 years ago it was underplanted with beech, but as a portion of this did not succeed, repairs were carried out between the years 1877-90. In 1889 a thinning of the oak was made, yielding 30 cubic metres per hectare.

The wood is now an excellent type of a two-storeyed high forest: the oak overwood is nearly 30 metres high with a beech underwood up to 10 metres high. A valuation survey was made here in 1891. It will be instructive to compare the growth of the oak in the Viernheim forest

with that in the Spessart, and we will take a similar wood, though a little older, *viz.*, compartment Weisserstein of the Rothenboch Range:—

	Viernheim.	Spessart.
Age	81 years	100 years.
Number of stems per hectares	356	612
Sectional area	25.4 sq. metres.	30.8 sq. metres.
Mean height	27.4 metres.	24.8 metres.
Volume of timber . . .	345 cubic metres.	386 cubic metres.
Mean annual increment .	4.2 „	3.86 „

Compartment Neubrunnen Schlag IV. 19.—Area (a) 9.3 hectares. An oak wood 63 years old, originated according to Method I by sowing acorns along with the corn in the last crop after several crops had been raised. In 1880 it was underplanted with 62,500 beech seedlings, and again recruited in 1886-89 with 20,000 more. The cost of underplanting was 210 marks, including the price of the plants. Area (b) 18.4 hectares. An oak wood 66 years old originated in the same way as (a). It was underplanted at the same time, the cost being 410 marks per hectare. The whole compartment was lightly thinned in 1887-88 and 1888-89, yielding 2 cubic metres per hectare. Some of the beech plants had been brought from near Laubach in Ober Hesse (where they were self-sown). As many as half a million plants are sometimes procured from there in one year. They are planted with the planting peg. A hole is made with the peg, the plant put in, and the earth pressed to with the foot.

Compartment Munigstich.—Area 18.8 hectares. A Scotch pine wood 51 years old with a beech underwood. This area was originally a field which had become exhausted and was no longer fit for agriculture. It was bought up by the State for a small sum. Scotch pine was planted in lines 1.25 metres apart, potatoes being grown between the lines (Method II). During the last 25 years it has been thinned five times, yielding 2,200 cubic metres, or about 110 cubic metres per hectare. Six or seven years ago it was underplanted with beech which had been raised in a nursery under a shelter wood of Scotch pine. The growth on this area is certainly above the average of the forest generally, and goes to prove that land unfit for agriculture may yet be capable of producing good forest growth.

Near this compartment is an oak wood 62 years old which was underplanted with beech about the same time. The underwood is not so advanced as under the Scotch pine.

Compartment Beckersschlag, 18-b.—Area 18.4 hectares. A mixed wood of oak and beech 42 years old, the oak looking like an upper storey above the beech. The two species were sown at the same time, but being a locality much subject to frost, the beech was year after year injured, and so the oak shot ahead. A thinning was made here in 1887, and again in 1889, removing 22 cubic metres per hectare.

Compartment Kirchengarten, III-16.—Area 14.6 hectares. This is an example of a wood raised according to Method III. The oak was sown 17 years ago in alternate lines. Scotch pine seedlings, one year old, being planted in the intermediate lines, and potatoes and rye grown for four years. When the Scotch pine were seven years old their side branches were lopped to favour the oak. Some of them have recently been decapitated, and in another ten years probably all will have been removed.

Further on is an area of about 24 hectares of oak twelve years old and Scotch pine one year older.

The cost of sowing oak and planting Scotch pine in this area was	2,813 marks.
* The production of the field crops cost	2,132 "
<hr/>	
Total cost of operations	10,445 "
The crops sold for	10,938 "

leaving a surplus of 493 marks or over 20 marks per hectare.

LAMPERTHEIM RANGE.

This range was not so heavily burdened with rights as the Viernheim range, and consequently its condition has never been so low. The method of regeneration is usually by sowing or planting under a shelter wood: the system of silviculture, combined with agriculture, is not practised in this range. There is a certain amount of natural regeneration of Scotch pine, but especially of beech which sometimes springs up spontaneously even in areas where there are no mother trees. The soil is divided into two quality classes:—

I. Fit for oak, and

II. Not fit for oak on which Scotch pine is grown.

The following short descriptions and histories of one or two of the compartments will help to explain the treatment:—

Compartment Kroatengarten.—Area 75 hectares. In 1862 it was a Scotch pine wood 84 years old, with some scattered oak 177 years old, which it was decided to convert into a wood of broad-leaved species under a shelter wood. A thinning having been made on 22 hectares, 4,600 kilogrammes of beech and 3,400 of acorns were sown in the autumn of 1862; on another 8.5 hectares, where there was a large proportion of oaks, 3,600 kilos of beech and 200 of acorns were sown. The shelter trees were gradually taken out and only a few vigorous standards remain. Some Scotch pine have come up naturally: these will be cut out, as also the beech where threatening the oak.

Compartment 15-a.—Area 12 hectares. This was a fairly open wood of Scotch pine 91 years old with a few oak of double that age. Two thousand five hundred kilos of beech seed and 1,600 of kilos of acorns were sown and a cutting made in 1882-83 removing some of the oak. Thinnings were subsequently made in 1884, 1885, 1887, and 1888. Owing to the removal of the shelter trees a number of blanks were left which were planted up in 1884-85 with 1,500 spruce plants. The cover appears too dense, and the spruce do not look in good condition. ●

Compartment Oberwildebahn 25.—Area 22 hectares. In 1820 this was a Scotch pine wood in the pole stage. In 1824 a number of the poles were cut out for drying tobacco which was largely grown in the district. In the open places thus created oak and beech sprang up, the seed transported by birds. The management took advantage of this undergrowth and helped it on by cutting out the Scotch pine, leaving only a few promising standards. The result is now a beech pole wood with some oak forming a complete cover, with here and there some fine standards of

Scotch pine. It was the success of this process initiated by nature which induced the management to carry out the conversion of compartment Kroatengarten above mentioned from a coniferous wood to a wood of broad-leaved species.

Compartment Oberwildbahn 91.—Area 23 hectares. An oak wood 97 years of age. Beech and lime, which were brought in as an underwood, are now of the same height as the oak. Lime is not good as an associate. It branches and takes up too much room. Thinnings have been carried out in this compartment as follows :—

In 1885 removing 115 cubic metres.				} Total 593 cubic metres. or 23 per hectare."
" 1886	"	369	"	
" 1887	"	7	"	
" 1891	"	27	"	
" 1893	"	50	"	

An attempt was made to regenerate an oak and beech wood naturally under a shelter wood by compartments. The result is a young generation of almost pure beech, and so the oak has had to be planted in.

The Scotch pine is usually sown broadcast. Where there is great depth of leaf mould, it is scraped together in ridges and the seed scattered broadcast between. The roots thus strike at once into the mineral soil.

About 20 trees of Scotch pine are left per hectare as standards. Some of them are blown down, and the management are satisfied if 10 per hectare finally remain.

WORKING-PLANS.

The working-plans, as in the case of the Frankfurter Stadtwald, are based on the system of dividing the rotation and the working-circle into equivalent and corresponding portions. Correlative to divisions of the rotation into "*periods*" is the division of the working-circle into "*periodic blocks*", each to be regenerated in regular succession during the respectively corresponding period. The division of the circle into blocks is the most important part of the scheme and is carried out in the following manner : A table is prepared placing each compartment *provisionally* according to its age-class into one or other of the blocks, those which contain the oldest stock, and of which the regeneration is most urgent, being placed in the first block ; the next oldest in the following block, and so on. The aim of the organisation is to bring each compartment under regeneration as near as possible the term of its exploitability. If the aggregate areas of the compartments falling into each block are nearly equal, a sustained yield is assured for the whole term of the rotation. But it is seldom that the formation of the blocks can be effected under such simple circumstances : generally one or other of the age groups preponderate and others are deficient or entirely wanting ; and some sort of a compromise has to be made between a fluctuating yield and the exploitation of certain woods either before they are fully ripe, or after their proper period of regeneration. The areas are as far as possible equalised by supplying a deficiency in one block by a surplus in the next, woods showing good increment being put back and others deficiently stocked or showing bad growth being put

forward ; and though a steady yield is much to be desired, it must not be sought by exploiting any valuable crops which may exist long before they become exploitable. As it is difficult to arrange in advance for more than one period the succession of the principal cuttings, and to calculate the yield of each period of the rotation, the working-plan is drawn up for only one period,—20 years.

Having re-arranged the compartment into periodic blocks, the next step is to calculate the annual yield. With this object a careful valuation is made of all the compartments falling within the first period and their increment estimated during half the period, and the total volume thus obtained divided by the number of years in the period gives the annual yield. A statement is then drawn up in tabular form showing the different compartments of the circle, their areas, stocking and the various operations to be carried out in each during the period, in the case of those of the first periodic block the order in which they are to be filled, the estimated yield, etc. The thinnings are fixed by area and the yield estimated.

A revision is made of the working-plan after half the period is passed and the yield recalculated and, if necessary, adjusted.

FORESTS OF KAISERWALD AND GRAFENHAU-
SEN NEAR KIPPENHEIM IN THE RHINE
VALLEY.

1st July 1893.

THE FORESTS OF KAISERWALD AND GRAFENHAUSEN NEAR KIPPENHEIM IN THE RHINE VALLEY.

These forests are of interest on account of their method of treatment,—coppice with standards. Kaiserwald is a State forest. Grafenhausen, which adjoins it on the west, is the property of the village of the same name. There are other village forests in the vicinity the returns from which as in the case of Grafenhausen cover all municipal expenses, and the inhabitants have to pay no taxes and no school-fees.

The forests are situated in the plain between the Black Forest on the east and the Rhine on the west. The area of the Kaiserwald is 149 hectares of which 1 hectare is unproductive. The area of Grafenhausen is one hectare less. The two forests are treated on exactly the same lines, and so it will be necessary to describe only one, the Kaiserwald.

The elevation of the Kaiserwald is 170 metres. The differences in level are slight but quite sufficient to influence the condition of the soil and consequently of the growth. The soil is described as being loamy sand, fresh, deep, rich in humus, of very good quality, overlying a stratum of more binding clayey soil under which there is a stratum of gravel. In the hollows the soil is moist, the water-level being only about 1 metre below the surface. On higher ground the soil is drier and less deep, and there is noticed a change in the species.

The principal species are—

(a) *Dominant*—

(i) *Overwood*.—Ash and oak (the pedunculate variety).

(ii) *Underwood*.—Ash and alder.

(b) *Secondary*—

(i) *Overwood*.—Alder, elm, poplar, maple and hornbeam ;

(ii) *Underwood*.—Aspen, hornbeam, hazel, elm, maple and shrubs.

Where the soil is dry and shallow hornbeam prevails in the underwood and the oak succeeds better than the ash which shows a tendency in such places to grow stag-headed after the age of 60 years. Where the gravel is moist, the ash, the hazel, and the elm prevail ; and where it is wet the oak is wanting, while the alder, elm, and hazel abound. In the moister localities in the village forests, where the growth is more vigorous, the rotation is fixed at 25 years, while in the Kaiserwald and in other parts of the village forests the rotation is 30 years.

The rules of management are very simple. The forest is divided into 80 compartments of 4·85 hectares each, one of which is cut over every year. First all the coppice shoots are cut, then all the standards which are not worth reserving owing to defective growth or otherwise. Seventy cubic metres of standards are left. The instructions lay down that the standards must be seedling and not coppice shoots, and are to be as numerous as possible without injuring the underwood ; in some places

they may even be allowed to form a complete cover. A counting made in compartment 22 shows that on the average—

about 8 standards per hectare over 90 years of age are left ;

„ 20 „ „ between 60 and 90 years ;

„ 400 „ „ about 30 years of age ; and

that about 1,500 stems per hectare are removed at each cutting.

Alder is ripe at 60 years and ash at 90, and therefore are not, as a rule, kept as standards over those ages. The oak is usually cut at 120 years, but is sometimes kept till 150, and in exceptional cases even till 210 years.

A few natural seedlings of ash and sometimes of oak spring up here and there, but natural reproduction of these species is of very inconsiderable extent, and the area has therefore to be regenerated by planting.

The felling is done in November and December. The produce is sold in January, but not removed in time to allow of extensive plantings being carried out that spring. Most of the planting is therefore done in the second spring, but repairs usually go on for another year or two. From 1,600 to 1,800 plants are put in after each cutting. The plants, chiefly ash, oak, and maple, are raised in large permanent nurseries. The ash seed ripens in July and is sown in the following spring, but most of it does not germinate till it has been a year in the ground, while the oak and maple germinate very soon after sowing. The ash is picked out in the nursery at two years and planted out in the forest at four to five years of age when it has attained a height of one to two metres. The oak is not transplanted in the nursery ; it is planted out when five years old and one to two metres high.

The tending and treatment of the woods will be best understood from the following short descriptions of some of the compartments :—

Compartment 22.—Cut over last winter. The wood was not removed from the area in time to plant up all, but it has been partly planted. Owing to the abnormally dry weather this year the tops have all dried up and the plants will have to be cut back. The average height of the standards left are—

over 90 years of age, oak and ash 26 metres high (one ash was 29 metres high) ;

over 60 years of age, oak and ash 24 metres high ;

30 years of age, „ „ 19 „ „

Compartment 21.—Cut over in winter of 1891-92. Occupies higher ground than the last and therefore the soil is drier. The ash would have become stag-headed, and so no standards of ash over 60 years of age have been left. Underwood about two metres high.

Compartment 19.—Cut in 1890. A cleaning has just been made. Wild hop vines have been cut and aspen, hazel and cornus been cut back. Underwood about 2½ metres high.

Compartment 22 (Grafenhausen).—Cut in 1883. Thinned last year when 16 cubic metres of branch wood, principally hazel, were taken out which sold for four marks per cubic metre. Mean height of underwood nine metres.

Compartment 2.—Cut in 1873. Thinned in 1884. Will be thinned again next winter. The aspen have grown most rapidly and are in places suppressing the oak and ash shoots and the young brushwood. It will be cut out in the next thinning.

Compartment 1.—Cut over in 1872. Thinned in 1883, and again last winter, when all the defective trees and shoots, and soft woods like the aspen, were removed.

The after treatment may then be said to consist in (i) a cleaning about the third year after the felling, in which all the hop vines which twine round and choke the young shoots are cut, and aspen, hazel, cornus and brambles are cut back; (ii) a thinning at the age of 11 years when all the soft woods which interfere with the principal species are cut out; also all the hazel, one shoot in each bunch being sometimes left if not in the way; and (iii) a second thinning at the age of 21 years when all the defective trees and shoots are cut out and soft woods like the aspen. It is to allow the aspen to grow on till the age of 20 years when it becomes saleable, fetching 10 marks per cubic metre for paper pulp.

Ash stools are used twice only; they send out shoots for a third time, but they are feeble and do not stand much chance against those from younger stools. Oak is used for four or five rotations only. This accounts for the large amount of planting that has to be done, as many plants being put in as there are stems removed.

The Kaiserwald is estimated to contain a growing stock of 26,365 cubic metres with an annual increment of 1,164 cubic metres, equivalent to 7.87 cubic metres per hectare. The area cut over annually is 4.85 hectares yielding 1,061 cubic metres. The yield for the 10 years, 1882 to 1891, was 13,000 cubic metres or 8.80 cubic metres per hectare, of which 23 per cent. was timber and the rest firewood. With the method of treatment a larger percentage of timber could scarcely be expected.

The best ash timber is sold to the Military Department for the manufacture of gun carriages, and fetches from 33 to 74 marks per cubic metre. Oak timber sells for from 26 to 56 marks per cubic metre. Alder 23 marks.

Split ash firewood fetches from 10 to 13 marks per cubic metre.

Ash billets	9 marks,	" "	"
and alder	8 marks,	" "	"
The gross returns from timber are	15,733 marks ;		
and the expenses on the same	2,080 "		

leaving a surplus of 13,703 "

or 92.80 marks per hectare per annum. Grass sells for 1,700 marks per annum. Roads cost 140 marks and cultural operations 1,760 marks per annum.

NOTES
ON
THE DEODAR:
A SYLVICULTURAL SKETCH.

BY
B. RIBBENTROP.



S I M L A :
PRINTED AT THE GOVERNMENT CENTRAL PRINTING OFFICE.

1899.

THE DEODAR.

The deodar forms unquestionably one of the most picturesque features in the landscape of the Western Himalayas. It relieves the somewhat monotonous grandeur of the vast mountain slopes, both by its form and colour, and when perched, as we often find it, on inaccessible and dizzy heights, gives additional charms to bold precipices and rock effects.

It is graceful in youth with its slender shoots, half-drooping side branches and its tender colours, varying from soft grays to luscious greens of every variety of tone and tint. In age its main characteristic is a majesty, whether viewed in a forest of mighty stems with the full vigour of an evenly developed crown, or when it expands and broadens in solitary dignity. Even when its position, or the vicissitudes, hardships and mishaps of life have rendered the tree stunted, gnarled and grotesque, it never loses its look of dignity and importance. And good reason the tree has to assume the looks and behaviour of a member of an old aristocracy; for are not the temples which still nestle in its shade, built as much as 500 years ago and longer by the sacrifice of the heartwood of its ancestors

No doubt in modern times we put a greater strain on the material than it had and has to bear in the clumsy and wasteful structures of the old Hindu temples, and we rattle the wood to pieces in ten or twelve years by the passage of numerous trains over the sleepers sawn from it. However, even under these conditions—the most trying, perhaps to which timber can be exposed—the deodar maintains its position as a prince amongst woods, and but rarely decays whilst its structural strength remains unimpaired. Impregnation with antiseptics is therefore not required. The transverse strength of the timber is well above 300, and its weight per cubic foot rarely exceeds 35 pounds.

All this renders the deodar the most valuable wood of the hills of Northern India, and commends the tree to the Forester's special attention. It goes without saying that a timber like this was highly valued from time immemorial; but the demand in days of old evidently did not rise

beyond the natural possibilities of the forests, or if it did so occasionally, the forests have outgrown the consequences. It was under British rule that the demand for deodar timber rose to such an extent as to threaten the permanency of the supply; and in the case of Native States, who control the majority of the deodar forests, this danger is not even now altogether averted, though, in justice to Kashmir, it must be said that of late they have introduced a management as conservative as our own. And, after all is said, we began by treating or maltreating our British Indian forests in the same reckless manner, exploiting them like a coalmine, cutting them down without any regard to their regeneration, and allowing forest fires to enter them and render destruction more complete. Unquestionably considerable areas were thus destroyed beyond hope of recovery, but the devastation is not so general as was at one time anticipated by numerous Foresters, myself included. In many places where the conditions were favourable and where some seed-bearers had been left, the forest has, under protection, to a great extent recovered and even re-established itself.

The reproductive power of the deodar is considerable and gives the Forester great scope for judicious treatment; and it is the main object of this sketch to draw the attention of Foresters to the opportunities they possess in this direction.

The range of the indigenous geographical distribution of the deodar is, so far as I am aware, limited to the southern slopes of the Himalayas from the Alaknanda in the east to the Kabul river in the west, and its vertical *habitat* extends generally from 4,000 to 10,000 feet. This zone, however, is, owing to local conditions, considerably modified, and next to the aspect, the amount of moisture in the soil probably exerts the greatest influence on the distribution of the tree. As a matter of fact, though, the tree will grow and flourish on almost any variety of soil. It is somewhat intolerant of the slightest deficiency in drainage; on the other hand, owing to its comparatively shallow root-system, it requires a certain freshness in the surface soil, and in consequence avoids dry-baked southerly slopes.

In March and early in April the little branchlets begin to get tipped with a tender bluish-green flush of new leaves. The first flower-buds, those of the catkins, appeared in 1898 in the beginning of June, and a fortnight later the young

male flowers began to push out of their sheath. Towards the latter end of the same month the first female buds were observed in their brown sheathing. In 1897 the sheaths of the female flower only opened towards the end of July, and the first male flowers were noticed on the 1st September. They are, however, very inobtrusive and may have escaped detection; nevertheless it seems evident that the season greatly influences the time of budding.

The male flowers appear with closed scales, which open only when they shed their pollen; whereas the females come out of the sheath with open scales which only close when they are fertilised about October. The young fertilised cones make but slow growth until spring sets in; but they make up for lost time and by July have often obtained full size.

Many unfertilised female flowers join in this spring growth, the scales still open, but they soon turn of a purplish tint, cease growing and decay. Male and female flowers grow, as a rule, on separate trees. There are, no doubt, many instances of the tree being bisexual; but in these cases the flowers of the different sexes do not grow on the same branches, and the fact remains that a very considerable percentage—probably half—of all deodar trees are only male catkin-bearing. This is naturally of the greatest importance in regard to seed fellings and the selection of the parent trees.

It is of course possible that the division between male catkin and cone bearing trees is not a constant feature; but observations made by me in 1898 lead me to believe that it is. The seed-year promises to be a particularly good one, and all female trees are covered with a crop of cones; but so far I have failed to discover buds of the catkins on trees which are cone-bearing all over or on fruit-producing branches of bisexual trees.

The seed matures in October and November and falls naturally about a month after ripening. The deodar is not a very prolific seeder; but, as a rule, bears enough for all purposes.

Exceptional seed-years may be expected about every four or five years, and a failure of the crop occurs at about the same intervals.

The deodar is eminently gregarious and, as a rule, occupies well defined zones within its geographical and vertical

limits, favouring northerly rather than southerly aspects, and growing to the greatest advantage on gentle slopes and old terraces of deserted fields, where the accumulation of soil behind the retaining walls results in the most excellent growth. The chief characteristic of the localities it likes best is invariably a fresh surface soil combined with a good subsoil drainage. The comparative length of the bole of existing trees may always be accepted as the safest criterion of the suitability of any locality for its growth. In these zones the deodar forms compact pure forests or is associated with *Quercus incana*, *dilatata*, *semicarpifolia*, the rhododendron and other broad-leaved species, and also with the various pines, *Pinus excelsa*, *Abies Smithiana* and *Webbiana*, and here and there with *Pinus longifolia* and *Gerardiana*. The Cypress and the *Taxus* are also found in deodar forests.

With some of the broad-leaved species, such as the oaks, rhododendron, and a few others, the deodar lives generally in harmony and frequently asserts itself at their cost. The gentle drooping of the terminal shoot, just as if it had not got the power to grow straight, is but a make-believe. This very elasticity, combined with the fact that the young plant has considerable shade-enduring powers, enables the tree to avoid obstacles overhead and to pierce through the very crown of oaks, rhododendrons and other fairly densely-leaved species.

I know several instances, which have occurred since I came to India, of, in some cases unaided, transformations of what appeared to be almost pure oak and rhododendron forests into deodar pole forests. It is evident that by judicious treatment this process can be accelerated, and this opens a field for the Forester's interference. The tree, however, does not take kindly to companions such as the walnut, maple and cherry, and other trees which, by their nature, prefer a locality damper than that best suited to the deodar. In such localities the deodar has no home; but there are many instances in which the uncongenial broad-leaved species have intruded on deodar ground and rendered it moister by their cover, and in such cases the intruders may be gradually expelled with great advantage to the more valuable species.

Where the deodar is found in admixture with *Abies Smithiana* and even more with the *Webbiana*, this happens

mostly in places where the latter trees have intruded on the natural zone of the former, or in the region of the *Abies* when on cliffs, or where, for other reasons, a more favourable opportunity has offered itself for the establishment of the deodar. There seems to be nothing in the growth, either above or below ground, of either of the *Abies* prejudicial to the deodar freely associating with them; but in cold damp glens, mostly with a northerly aspect, which are the favourite localities of these species, the deodar does not naturally thrive; and if it grows, often develops a spongy fibre entirely opposed to its natural characteristics. In some instances when in the earlier stages of forestry the growth of the tree has been forced by artificial cultivation in such localities to which the tree has a natural aversion, its early growth was fairly rapid, but after some years ceased, and signs are not wanting that the trees in these early plantations are deteriorating. In some instances, I am informed, they are actually dying after reaching a height of upwards of 25 feet: an excellent lesson against trying to make trees grow in naturally uncongenial places. *Pinus longifolia* and *Gerardiana* may probably afford some protection to the young deodar plants; they certainly do not interfere with their subsequent growth, but, on the whole, they are unimportant as associates.

This cannot, however, be said of the intermixture of deodar and blue pine, a species which, generally speaking, occupies the same zone as that of the deodar, though often extending to a higher elevation, where in fact it frequently grows, especially in moderately damp localities, to a greater age and larger dimensions than at a lower altitude. The deodar and blue pine are certainly found naturally associated, but it is a constant war between the two, in which the less valuable tree gets but too often the upper hand, especially where new forests have established themselves on deserted fields or on abandoned *kordli* cultivation, but also in forests which have been brought under the axe before a Forest Department was established to guide these operations. The *excelsa* starts with the advantage of producing light large-winged seed, which gives it a much larger radius of reproduction than the deodar possesses, and the young plants grow up readily without shelter. Moreover, an examination of the upper growth and the root-system of the young deodar and of the blue pine seems to show at once that they are not by nature intended to grow together;

and, as a matter of fact, though I have frequently examined the position, I have never found a true mixed forest of the two species of the same age and of equal height of canopy. This, however, does not refer to single trees scattered about in forests of the other species, which probably have grown under exceptional circumstances, like the solitary deodars or even pure groups we find in the *Abies* forests. The young deodar forms a slender cone above ground, and has a comparatively small, shallow, much-divided and feathery root-system, and its early growth is by no means rapid. The young blue pine, on the other hand, spreads out its branches after the first few years of growth, not merely its lower ones, but even those fairly near to the top. Its root-system is similar and penetrates both far and deep; according to my observations, it spreads its roots on rich deep soil three times as far as the roots of young deodar of the same height, and further. It thus interferes with the deodar both above and below ground; and in the earlier stages its growth is very much faster.

Another curious fact is that the deodar when once overtopped by young blue pine seems to lose its faculty of piercing cover overhead; though the foliage of the *excelsa* is much less dense than that of other associates of the deodar which it conquers. The small plants live for years in the blue pine thickets, but they make no progress and, as a rule, ultimately disappear before the forest has reached the later pole-stage. Exceptional deodar seedlings which have struggled on till this happens may finally survive, but it seems doubtful whether they will ever form good trees.

From the above it would appear that the deodar would have no chance in its battle with the blue pine; nor has it on a deep loamy soil, especially on open and sparsely-shaded ground, though seed-shedders of both species may exist in the vicinity. The almost pure *excelsa* thickets and pole forests which fringe many of our nearly pure deodar forests are clear evidence of this. There are, however, conditions and circumstances which render the deodar more able to hold its own than would appear to be possible at first sight. The tree attains a greater age than the *excelsa*, is in its early youth much more shade-enduring, and is thus frequently found well established, even in mature blue pine forests, before young growth of this species can intrude, and having a much closer root-system can thrive on rocky

broken places, and on shallow soils where the blue pine does not find scope for its more ample root-system. The latter is also less tolerant as regards its own species. Nevertheless it is one of the chief duties and pleasures of the Forest-officer, whose good luck has placed him amongst the deodar forests, to protect this most valuable species against the *Pinus excelsa*, its most formidable rival. I shall refer to this again in the treatment of deodar in mixed forests.

The natural tendency of the deodar is to form a pure forest or groups, and in this it ultimately succeeds, or if conquered is, in the course of generations, ousted from the field of strife. Once a pure deodar forest is established, it has a great inclination to grow into a regular forest with a canopy of equal height. Each individual is very persistent in this struggle, and the natural process of thinning is an extremely slow and uncertain one, the result being frequently a crop of tall lanky poles, thin in the boles and narrow in the crowns, and consequently extremely sensitive to sudden exposure.

There is, perhaps, no tree in India for which the advisability of artificial thinning in the earliest pole stage is more clearly indicated, not merely because the operation when protracted becomes more dangerous, but in order to cause from the outset the development of strong boles required for the maximum production of scantling.

In the Kulu forests a number of pattern plots have been examined in areas which have grown up untouched by the axe. These areas at an age from 70 to 80 years contain 100 to 1,000 trees per acre: but hardly any of these trees are over 12 inches in diameter, and consequently none of them are as yet capable of yielding scantling for export. One of such plots in the Jackrasi reserve in outer Seoraj, aged 68 to 80 years as judged by the number of rings on specimen trees felled, was found to contain 703 trees per acre, measusing from 3 inches to 15 inches in diameter. The average diameter of 158 trees representing the dominant class, if it is permissible to call any trees leaders in a forest of such description, was found to be 11 inches. The average age of these trees may be assumed to be 80 years. The total cubic contents were worked out and found to be 7,526 cubic feet per acre, giving an average annual production of 94 cubic feet. The outturn in scantling, however, is estimated to amount only to 10 per

cent of the total, or to less than 10 cubic feet per acre per annum. The forest contains a number of dead poles, and a considerable amount of dead wood had been removed in the course of the last 30 years. This is a specimen of a naturally reproduced deodar forest in a favourable locality in which the struggle for existence was allowed to go on unaided. It goes without saying that the future working of the lanky forest presents considerable difficulties.

The results of trial-plots in which a forest of similar age and constitution had grown up under different conditions of treatment are not at present readily available, but opportunities will no doubt be taken by officers in charge of hill divisions to supply this want later on. In the meantime it will suffice for the purpose in hand to give a few examples of forests which for one reason or the other have grown up less densely.

The Sial Bihal forest in 1870 contained a small number of scattered mature deodar and a very scanty sprinkling of badly grown advance growth. Planting operations with naturally grown seedlings of three or four years old had gone on for a year or two and were completed by the writer of this article.

The average age of the crop may be said to be 32 years old.

The present composition per acre is —

	C. ft.
146 trees of 10 to 15 inches diameter containing...	3,500
184 „ 6 to 10 „ „ „ ...	1,700
51 „ under 6 „ „ „ ...	100
Total... 381	5,300

The average height is 62 feet, maximum 73, clearly proving that the open growth has by no means improved the growth in length.

This shows an average yearly increment of 165 cubic feet. Drawing conclusions from adjacent groups of trees,

The average annual increment in scantling alone may, therefore, be estimated at 50 cubic feet, at present prices worth at least 25 rupees net, against less than 10 cubic feet in the Jackrasi reserve during the same number of years.

In further support of the advisability, if not the necessity, of thinning operations, we have only forests which were cut to supply current requirements.

C. ft.
of scantling.

	22 trees of 24 to 27 inches diameter containing...	1,320
40	" 21 to 23 " " "	1,600
48	" 19 to 20 " " "	1,200
25	" 15 to 17 " " "	400
Total ...	135	4,520

The age of the trees felled varied from 145 to 170 years, and the average increment as regards scantling, counting the main crop only, may be put down as 80 cubic feet per acre.

The distribution of the *peuplement* indicated that had the thinning operation been more regular the outturn in scantling would have been greater.

Other trial-plots tend to show that in Kulu we can, under average conditions and with rational thinnings in pure deodar forests, count on an average annual outturn per acre of 30 cubic feet scantling; and it seems strongly indicated that by such thinnings we at least double the outturn of the material which we wish to grow.

Even in mature forests, frequently represented by sacred groves surrounding temples, the inclination above noticed of the individual tree to have its head on the level of the general canopy, and its wonderful power of achieving this, is often exemplified by thin-boled attenuated trees of less age, which have gained a place in the general canopy quite out of proportion to their girth. That trees of this description have not sufficient power of resistance if deprived of support is evident, as well as that they are quite useless as parent trees in the present stage, and that it would require too much time to render them prolific. They must, in spite of their comparative youth, almost invariably come down with, or even before, the main crop; even though they will add but little to the outturn in timber.

It is evident that all the trees, young or old, in forests of this description are, owing to the compressed state of their crown development, extremely bad seed bearers, and that as their opening out is connected with many and great climatic dangers, it is extremely difficult to reproduce them naturally and without having recourse to artificial planting.

Not many forests of this class are now in existence in British territory, but they are still found in Jubal and other Native States. Some years ago they were numerous all over the west Himalayan valleys, and as striking examples may be cited the deodar groves round the temples in Nachar, in Bashahr, and Dungri in Kulu, which with a compact and more or less level canopy contained trees varying in age between one hundred and four hundred years. Such forests doubtless grow some giant trees, but at a terrible sacrifice of space and time.

As already stated, the majority of forests of this character have fallen under the axe; many were felled, during

the first boom in the demand for deodar timber, in a most reckless and wasteful manner; but others were attacked systematically with a view to obtaining their natural reproduction.

Let us examine *seriatim* the result of the various treatments the deodar forests have been subjected to. We have, first, the utterly reckless fellings by contractors and timber-merchants, which began late in the fifties and lasted in full force till 1863. The amount of destruction that took place in these few years is simply marvellous, and is only accounted for by the fact that thousands of trees were only felled and never extracted, and that the operations were accompanied by an utter disregard of the effects of jungle fires, which consumed enormous quantities of valuable timber already on the ground, destroyed existing advance growth, and injured the few trees that were left standing as possible parent trees of a future forest. The deodar is very sensitive as regards forest fires.

The consequence of these fellings was the springing up of low scrub in some cases favourable, more often injurious, and frequently prohibitive, to deodar reproduction. The latter is specially the case when the scrub growth is composed of wych-hazel, *Indigofera* and even more so if formed or intermixed with wildrose and brambles, which nearly always form dense impenetrable thickets. On the other hand the *Berberis* and some other bushes frequently act as useful nurses; the majority of the species in this scrub jungle, such as *Abelia*, *Lonicera*, *Viburnum*, *Sambucus*, etc., taking their places between the two extremes.

Even the *Parrotia*, *Corylus* and *Indigofera*, however, do not grow with equal vigour in all localities, and there is a great variety in the constitution and denseness of these thickets. On many well-drained northern slopes and other favourable localities the deodar is re-establishing itself by favour of the few scattered parent trees which were spared. It is nevertheless evident that wholesale initial clearings, leaving only a few trees per acre to shed seed, are to be avoided; and is only excusable if accompanied by an immediate and a wholesale planting of the area felled over.

The first foresters, with the, at the time, entirely unobliterated and unrepaired destruction before their eyes, fell frequently into the opposite extreme, and excessive caution often

became the order of the day, and the most careful, frequently repeated, fellings were carried out in many localities. The result was not generally satisfactory. The trees thus opened out doubtless developed their seed-bearing powers in course of time, and as the seed produced by deodar is, as a rule, fertile and germinates in considerable shade, initial reproduction failed but rarely; however the seedling is extremely susceptible to any excess of moisture and in the shade the majority of the young plants were threatened by damp in their first season of growth. With successive selection fellings more favourable conditions naturally arose, but then a new difficulty appeared in another direction; the openings which had thus been formed too gradually, favoured the production of grass, and by the time sufficient light had been admitted for the establishment of a plant, this almost invariably prevented germination in contact with the soil, and artificial cultivation remained the only resource.

In other instances holes and strips were cut into the mature deodar forests before the seed-bearing faculties of the trees on their edges had developed. In many cases this was successful, but as often it was found that by the time the exposed trees began to bear seed, the soil in the openings was too densely covered with weeds and grass, and even shrubs and brambles, to prevent the successful establishment of natural seedlings, and artificial cultivation had here again to be greatly resorted to, as for instance, in Nachar, Dungri and many other forests where this treatment of successive selection fellings was adopted.

What then, it will be asked, is the most rational way of naturally reproducing a mature regular deodar forest? I am convinced the correct answer is by successive regeneration fellings commencing with a careful preparation of the crown development of carefully selected seed-bearers, and by a subsequent severe opening around trees which give indication of becoming good parent trees to be followed, if necessary, by a further clearing and ending with the removal of the mature crop. There will be some difficulties in the first selection of parent trees, for since we suspect that only a certain percentage are cone-bearing, we cannot be guided merely by the looks of bole and crown, but must make sure of the sex as well. Once these trees have been found and marked, they must be most carefully opened out during successive years, so that the crown may spread and the tree

become more prolific. That this is the natural consequence of the gradual isolation from the compact canopy is evidenced by experience in our former fellings, and when this has happened, the surrounding crop must not be spared. Frequently advantage may be taken of a good seed year, which can, barring unforeseen accidents, be foreseen twelve months before its occurrence. That such accidents may happen, however, and are perhaps not unfrequent, was clearly evidenced during the past season, which began with a promise of an excellent seed-year. I observed at the commencement of July that a large number of the young cones looked unhealthy, and from that moment a careful watch was kept, and it became at once evident that they had been attacked by some insect. A history of this attack, as studied by Mr. Beadon Bryant and myself at Simla, is appended. Suffice it here to say that the prospects were entirely changed, and that almost the whole crop was lost.

The deodar sheds its seed naturally within a radius of 50—100 yards, and as the mosses and humus will be well disturbed and the soil wounded by fellings and timber operations, large openings can be made without much risk of failure. It is advisable, however, not to let the felling operations spread over the whole forest, but to leave intervening portions or groups untouched, as a protection against climatic dangers, merely fostering the seed-bearers within such localities till the reproduction in the attacked areas is fully established. In places where by design or more frequently by accident—as, for instance, in Cheog in the Simla district—the felling operations were of a character similar to that above described, the reproduction is perfect, and the only measures required are protection, especially from fire, and early thinning operations.

But however carefully the fellings may be made, the fact remains that some herbaceous growth will spring up as soon as sufficient light is let in to make the trees produce seed. It is, therefore, necessary that the severe opening out should not be delayed long. It should in fact take place on the first indication of the trees beginning to grow seed; and soon afterwards the herbaceous growth, grasses, and bushes that may have sprung up should be cut back for a year or two, at the end of the rains—an operation which is not very expensive, but which requires some care, so as not to demolish the young seedlings, which may have

sprung up. The advisability of this operation is frequently illustrated by the fact, that areas in which under such conditions a certain amount of grazing had taken place show often a better reproduction than those in which the herbaceous growth has remained entirely unchecked. However, there can be no doubt that a larger number of seedlings must get destroyed by the hoofs and mouths of cattle, than by a somewhat careful cutting back of the bushes and other growth. Previous to the severe seed felling, the admission of cattle into deodar forests is, in my opinion, beneficial; they counteract the admission of the first light let in as regards the springing up of herbaceous growth. There is no danger in this kind of forests of hardening the soil, and the few seedlings which may be destroyed at that period are of no importance.

As regards thinning operations, it is of course desirable that trees should draw each other up in order to produce long boles; but the advantages of an extremely close growth in this respect is frequently overrated, and we see everywhere examples of lanky pole forest in which early thinnings have been neglected, and where though urgently needed such operations have now become so delicate and dangerous, that a Forester only ventures to carry them out with considerable hesitation and misgiving.

We must never lose sight of the fact that our aim in the treatment of deodar forests is to produce big timber for export and individually strong full-boled trees. The species, as already stated, thins itself badly if the process is left entirely to nature; and in the absence of comparatively early and periodically repeated artificial thinnings, the best results will not be achieved. These thinnings, however, especially the latter ones, must be lenient, as the tree even in fairly close order grows magnificent stems and productive power would consequently be wasted by placing them in a more open position than necessary. Special caution must be observed when danger from snow exists, but it is evident that the danger only increases by hesitation and delay.

In course of time and with the help of artificial cultivation which, even under the treatment noted above, should always be resorted to when natural reproduction is incomplete from the outset; this should not be delayed too long, as it is essential that the final fellings should take place whilst the young growth is small and flexible and can easily outgrow the damage done.

Most of our systematically felled forests, and many others, have fairly reproduced themselves. They however but rarely present the picture of a true *jardinage* forest, and when they do so at present, this appearance will be obliterated in the course of years, and long before they reach maturity; for, as a rule, the interval between the first fellings and completion of the reproduction has been much too short. They will most certainly grow again into forests with a level canopy, and will have to be treated as such.

To maintain a true *jardinage* system in pure deodar forest is, when once established, feasible. There is nothing in the nature of the tree to prevent it; but it requires constant attention and very frequent fellings, as poles of an equal height will take possession of the ground and interruptions in reproduction must take place—such as is at present experienced in Kalatop in the Chamba division. The establishment of a true *jardinage* of pure deodar forest is extremely difficult; and, on the whole, I am inclined to believe that it is not worth while to try and obtain it, and that the treatment indicated for the tree is, except in very rocky and steep localities, either the regular forest method or group *jardinage*, the latter by preference when the forests are exposed to special climatic dangers, which is frequently the case.

The treatment of the deodar in mixed forests has led to very varying results; but, generally speaking, we may say that we have gained ground rather than lost it, and we have gained experience which in the future is certain to lead to more favourable and certain results.

As regards established mixed forests the process is a simple one, which needs no detailed arguments in favour thereof. All trees of other species which interfere with the upward growth of healthy deodar of all ages, or with their vigorous crown development and the ready growth of the parent trees, must be removed or killed when their removal is too costly. Much can be done in this direction in many places by adopting the greatest liberality in disposing of inferior trees; and it is evidently more profitable and safer to give away trees of this description, than that they should be felled and left lying on the ground filling the forests with dead wood, and thereby increasing dangers from fires and insects.

The difficulty in the treatment of mixed forests begins with their exploitation and reproduction. In the first instance

the deodar is frequently, nay mostly, the only tree in our Himalayan forests which it is at present worth while to extract for export, and the local demand for other species is not, as a rule, sufficient to counteract this. This, of course, places the tree at once at a disadvantage, and indicates that a complete reproduction should first be insured before the present trees are removed. The first fellings, made by contractors, luckily never extended very far into the mixed forests; so long as pure deodar forests, mostly more favourably situated, offered an easier field for their exploits, the contractors confined their attentions to these. In some instances, however, the fellings spread into the mixed forests, and in such cases whole groups of equi-aged deodar were frequently cut down, perhaps more in the Sutlej valley than anywhere else, and other forests took possession of the ground. The same effect was naturally caused by the removal of solitary species of the tree.

In many cases, however, when deodar seed-bearers were left, a mixed reproduction took place. And the same result has been obtained by subsequent and more systematic fellings. When such fellings took place in forests of deodar mixed with such broad-leaved species as oak and rhododendron, and when they were of sufficient extent to cause a permanent opening in the canopy, we mostly find a fair sprinkling of young deodar which can be readily fostered and probably extended by judicious thinning out of inferior species and the lopping of the surrounding forest. This is also the case when in the *bonâ fide* deodar zone, fellings have passed through forests of deodar mixed with the *Abies*, and the young deodar growth seems to hold its own fairly well, and but little help is needed to make every established deodar plant, in so far as not hampered by representatives of its own species, grow into a useful tree. The experience thus gained by previous fellings shows us that by extraction, girdling or lopping of inferior trees in the vicinity of deodar parent trees, an advance growth of deodar can be raised with considerable chances of success, and where these operations have of late been carried out systematically, as for instance in Kathian, by the girdling of oak, and in Mandah and Deota by the girdling of spruce and oak, excellent results have been achieved.

In forests of deodar mixed with blue pine we find frequently that, where fellings have been lenient, an advance

growth of deodar has established itself with perhaps a young blue pine here and there; but that where holes of considerable extent were cut, the opposite has taken place, and that thickets of *excelsa* have established themselves with a few young deodar, which, if not already killed out, are doomed unless helped by the Forester. The danger from scrub in forests of this description exists, but is much less accentuated than in pure deodar, as the blue pine is mostly even faster in establishing itself than the scrub.

It is the greater shade-enduring power of the deodar seedling of which the Forester should take advantage in the reproduction of a forest of blue pine and deodar mixed, in which the latter is represented as a parent tree. The removal of a few *excelsa* round such parent trees or groups of deodar, or the judicious thinning out of such groups, or even the lopping of the blue pine, will usually result in an advance crop of the more valuable tree, and will certainly offer favourable opportunities for its artificial cultivation; and once the young deodar have a ten years' start or so on suitable soil, it will be difficult even for the blue pine to overhaul them. The mere lopping of the blue pine and the protection of deodar has had the most marked effect in the Simla district and elsewhere, and has in some instances resulted in the establishment of pure, complete, young deodar reproduction in forests where this tree formed as little as 5 per cent. of the original crop. My experience is that when deodar and blue pine are found in admixture (with the exception of groups of some extent which may have grown up under conditions not now traceable), the former is either considerably older and has established itself before the surrounding blue pine grew up; or much younger, being a product of the time when the growth of the *excelsa* nearing maturity admitted sufficient light for the deodar, but not for seedlings of its own species.

It seems therefore quite rational to suppose that by taking advantage of this it will be possible to transform even pure mature *excelsa* forests into deodar by a judicious clearing, lopping and by underplanting. Under any circumstances it seems worth a trial.

The removal of inferior trees, not merely of *Pinus excelsa*, in order to foster existing, and to incite new, deodar reproduction, is a most important duty of the Forester; but if artificial cultivation is not contemplated, it should

take place only over advance growth and within a radius of 50 yards of a seed-bearing deodar mother tree. The selection of such trees must be carefully attended to, as it would be useless to girdle round an old male tree or a female which may be barren owing to the fact that no pollen-shedding tree exists in the vicinity. Lopping should also, as a rule, be confined to such localities. Where possible, the trees to be sacrificed for the deodar should be removed, and even yearly lopping is frequently more efficacious than girdling, which owing to the fact that the shade is removed too gradually frequently results in the growth of weeds and scrub. Experience has shown this to be the case in many instances, especially in nearly mature forests. Moreover girdling entails the danger from fire and the possibility of an insect plague.

When a mixed young growth has established itself, in which the blue pine is one of the representatives, the utmost care must be taken that this species does not get the upper hand over the deodar, which if left alone it does with incredible rapidity. We have lost several promising young deodar forests for want of such care by too long delayed interference.

It cannot be denied that young deodar frequently spring up under the protection of young blue pine, especially in dry sunny places, where without protection they would not have germinated, or at least would not have outlived the first season. On this fact the theory has been started that the *excelsa* is a useful nurse for the deodar. That such is the case as regards blue pine in the high pole and tree stage, especially when lopped, I have not merely admitted, but have recommended old blue pines as nurses. In its earlier stages, however, the *excelsa* is the worst of nurses to which a young brood of deodar can be confided. It wants constant looking after, or it overgrows and smothers its nurselings. I know several forests in which this happened. In 1874 I had occasion to visit the forests in Jaunsar and noticed many fairly well-stocked thickets of the blue pine and deodar in which the latter was getting the upper hand. With my then recent Bashahr experience of the aggressiveness of the blue pine fresh in my mind, I advocated at the time a severe interference with that tree. Amongst the areas which I visited were some small plots, perhaps a few areas in extent, in the Kathian forest, in close vicinity of the

bungalow, covered with a thicket of deodar and blue pine 4 to 6 feet in height, in which the latter was sufficiently represented to produce a deodar forest. At that time and for some years after the danger was not fully appreciated, and if interference with the blue pine took place, it was not carried out with sufficient energy and continuity; and the present result is a blue pine forest some 25 to 30 feet high, with the remnants of the deodar crop of the same age, as shown by the counting of rings in 1897, 5 to 6 feet high, still lingering below the *excelsa* canopy. The majority of the deodar seedlings I noticed in 1874 have died, and as regards the rest the time for useful interference has probably long since passed.

What took place in this instance on a small scale happened to a varying extent in all similarly situated and constituted forests, and can even now be verified by ring-counting of the *excelsa* and of the few surviving deodar.

Up to what period suppressed deodar may with advantage be cut free, and up to what age the lopping of the blue pine will help them to regain vitality and healthy growth, is a question for experts.

The fact, however, remains that a Forester ought never to allow himself for the future to be placed in a position in which this question comes under consideration. Interference can hardly be too early or be too vigorous; and as soon as a sufficient crop of deodar plants is on the ground to promise the establishment of a pure deodar forest, the temporary interruption of the close cover of the thickets is less to be feared than the presence of the blue pine therein. These latter must come out sooner or later, and by keeping them till they actually overtop or threaten to overtop the deodar, the power of these trees to close up will only be impaired.

Under most conditions it will thus be seen that there is a general tendency of the forests in which kail and deodar are associated to become, under fire-protection, pure blue pine forests, a tendency which becomes more pronounced where browsers have not been excluded, as goats and also sheep attack the young deodar, but leave the *excelsa* unmolested. However, by taking advantage, as I have endeavoured to show, of the very pronounced characteristics of the two trees, it by no means appears difficult to increase the percentage

of deodar in forests of this kind, and eventually to transform them into pure deodar forests.

There is not a hill division in the Punjab and the North-Western Provinces where a considerable field does not exist for such operations. There are—*firstly*, the mixed reproduction of blue pine and deodar which requires constant watching and clearing of blue pine; *secondly*, the mature mixed forests of these trees, in which young advance growth of deodar frequently exists, and merely requires assistance and the removal of the blue pine to enable the young trees to grow up vigorous and healthy; *thirdly*, similar forests in which it is feasible to obtain such deodar reproduction by a gentle opening of the canopy, by a cautious thinning out of the blue pine, or by, what is perhaps even preferable, their severe lopping; *fourthly*, pure mature blue pine forests, in which an underplanting with deodar, accompanied by a judicious exploitation, causing an interruption of the canopy, and by lopping, is an operation almost certain of success.

Attempts to transform pure blue pine thickets and forests in the pole-stage into deodar, or even to introduce this tree into the *peuplement*, must be unsuccessful at least at a reasonable expense. All we can do is to accelerate by judicious thinnings the time when such transformation may become feasible.

Fertile deodar mother trees are frequently found standing all by themselves or in groups in open grazing-grounds. How they got there, whether they are remnants of a former forest or are of accidental growth, it would be useless to enquire; the fact that they are there, usually stamps the locality as suitable for the growth of deodar; and experience has shown that when favourably situated on a northerly aspect, protection against grazing of a small area around them by means of a fence will by itself insure a complete deodar reproduction in the course of some years. There is nothing to fear in such localities from brambles and shrubs, and the process of reproduction can be greatly accelerated by wounding the turf in the vicinity of the parent tree; the few acres which by such operations are withdrawn from the usually extensive grazing areas are hardly ever of any material importance; and where this should be the case, they can, as a rule, be replaced by the abandonment of less favourable localities.

I strongly recommend these opportunities for the consideration of the Forester.

The artificial cultivation of deodar in suitable localities presents no special difficulties, and we can show really excellent results, especially in the Jaunsar division, in Kalatop, and other places in Chamba. In Kulu we have the Sial Bihal, Manalgarh, and Dana reserves, almost entirely artificially stocked, rapidly growing into a magnificent and perfectly stocked forest. The seed, as a rule, germinates readily, and the comparatively small root-system facilitates transplanting; but on account of the extreme tenderness of the root tips, an exceptionally gentle handling of the young plants is required. There must be no binding of roots in the plant hole, and each rootlet must be placed with the greatest care and gentleness in its original position, and only the finest soil must be used. On account of this tenderness of roots, basket planting has been frequently resorted to in the Jaunsar division and naturally with great success.

This method is doubtless expensive, but, considering the great future value of a well planted deodar forest and the great difficulty of supervision of unskilled labour with which we have to deal, I have come to the conclusion that the original expense is fully justified for the following reasons: *firstly*, the greatest certainty of success; *secondly*, the saving of a year's growth; *thirdly*, the saving of at least a year's nursing cultivation. Moreover, the method has the advantage that it makes the Forester more independent of a limited planting season; and if planted in spring, whilst more or less dormant, the new shoots will begin to develop in the coming rains.

I was for a long time opposed to this method on account of the expense, but the invariable success achieved by it in the School Circle has convinced me that so long as the precaution is taken to make the baskets broad enough, its more extended application is advisable, at least in all cases where the cultivation represents the least difficulty on account of adverse conditions, and more especially when planting operations are scattered and have to be left to the tender mercies of untrained subordinates.

The fact that considerable sums of money have been spent in various hill divisions on planting, with results quite disproportionate to the expense incurred, and the trouble and care bestowed on them is solely due to the fact that many of the

areas, frequently dry, bare slopes with southern aspects originally selected were unsuitable for the initial establishment of deodar growth, and to the desire of each Forester to succeed where his predecessor had failed. No doubt in many instances they have, by perseverance and the use of much skill and care, procured the establishment of young plants; but though they may be beyond danger of death, the appearance and forward growth do not give promise of the establishment of a healthy deodar forest, and the energies of the Forester might have been employed with greater advantage elsewhere.

It is quite possible that many of the barren slopes we have attempted to stock with deodar were once covered by trees of this species; but if so, these trees could only have been the result of an original mixed forest which preserved the freshness of the soil, and in this direction lies our only hope of success. All attempts to secure this by equi-aged nurses have naturally resulted, more or less, in failure. In many cases it was nearly as difficult to grow the nurse as the deodar, and it made as little progress, and where the kail was tried, its utility was either *nil* or, owing to its self-assertion, of a very temporary character.

In such cases it is essential that we should produce in the first instance a bush growth, and to begin with I strongly recommend the artificial cultivation of *Berberis* and *Indigofera* thickets. There is no occasion to let these grow so high and dense as to present a new difficulty, and as soon as they are well established the interplanting with deodar may proceed. In cases where the soil is extremely dry, it may be indicated that we should try to grow, in the first instance, a forest of trees intended as nurses only, and when these have reached maturity proceed to introduce the deodar. This is the conclusion I have arrived at after many visits to such localities and much deliberation. *Robinia*, with the cultivation of which great success has been achieved in the Simla hills at elevations between 4,000 and 7,000 feet, may probably be found useful. The tree yields excellent timber of great durability and good fuel, and so far as can be seen the deodar associates kindly with it. Already a considerable quantity of acclimatised seed is available and the supply will now increase year by year.

I have already mentioned our attempts to extend by artificial cultivation our deodar forests within the *band fide*

Abies zone. During my first years in India I experimented myself in this direction and prescriptions to this effect are contained in several of our earlier working-plans. Where little or no shade existed, these plantations gave on several occasions all promise of success, but they were entirely disappointing in the long run.

Considerable success has in several localities been achieved by the thinning out and underplanting of rhododendron and oak. This is, as a rule, where the conditions are otherwise favourable,—a comparatively easy operation and may with advantage be extended when opportunities offer.

It seems quite clear that we must confine our attempts in the artificial cultivation of the deodar tree to its natural zone, that is, to such localities where the presence of a mother tree would on an open soil ensure natural reproduction. In such places it is the duty of the Forester to replace by artificial means the absence of the mother tree, or to counteract the conditions of the soil which render natural germination in contact with it difficult or impossible.

In regeneration fellings when the soil and its covering are suitable, and even more so in duly prepared mature blue pine forests, working up of the soil in patches or strips and dibbling in of seeds has yielded in some cases, and will frequently yield, very good results; but underplanting, though more expensive, is always safer, and the time gained is in most cases worth the additional expense entailed. Under any circumstances it is always advisable to be prepared with a nursery to fill up blanks and failures in the original operations and also in natural reproduction.

When weeds or a close grass crop have taken possession of the ground, it will be necessary to have from the outset recourse to planting, and in the latter case it will be advantageous to remove the frequently felt-like root system of the grass for some distance from the plant hole.

The most difficult conditions, however, which fall legitimately within the Forester's scope of action is the gradual recovery of the areas of the *bona fide* deodar zone lost by injudicious exploitation, areas which are now covered by *Parrotia*, *Corylus*, *Indigofera*, and other shrubs and brambles, and which in their present state are of no use whatsoever, beyond yielding material for twig rope bridges, and of this a plentiful supply exists elsewhere. It is evident

that the reconquest of these areas, entailing the removal of roots and scrub and the careful preparation of plant holes, is comparatively expensive and perhaps can succeed only under perfect supervision and control. It must therefore be gradual, for success alone warrants the outlay.

That perfect success can be attained even in dense scrub, even on a considerable scale, is evidenced, amongst other examples existing in the Jaunsar and Chamba divisions, by the reconstruction of the Ragmudi reserve above Manali in the Kulu division. In 1870, when I saw this area first, it was covered with a dense growth of *Indigofera* and brambles. A few scattered trial plantations took place in that and subsequent years, the results of which are some groups and single trees. More extensive and thorough operations were undertaken in 1879 and continued for some years. The final results are excellent; the scrub, though as yet not generally suppressed, has been everywhere conquered and a sufficient number of trees to eventually form a fully stocked deodar forest, have their heads above danger. The situation and other conditions are excellent, and it may be safely predicted that the forest of the future will yield an annual increment of at least 40 cubic feet of scantling, amply repaying the somewhat heavy cost of the planting operations.

No Forester in control of a northern hill division should be content without having in each successive year regained a portion of these areas, nor without having considerably enlarged the zone of his natural deodar forests at the expense of the kail; and having, where fuel is not the first desideratum, laid the foundation of the conversion of a portion of his oak and rhododendron forest into deodar. If he does not succeed in this, he might, I think, with advantage be given a trial amongst the *jhând* or other equally pleasantly situated trees.

It is essential that the planting in scrub jungle should be sufficiently dense to give promise that the trees will close up when in the pole stage, and the planting, for cheapness' sake, of compact groups with great intervals between them is out of place. Former trials made in this direction are unsatisfactory; moreover, I consider it doubtful whether much money was saved by planting such groups in preference to distributing the same number of trees at an equal distance, say 10 feet by 10 feet, over a more limited area, giving each tree space for useful development.

It goes without saying that the original operation, having cost much money and trouble, the greatest care must be taken of such plantations till the young deodar has its head level with the scrub. Once this has been achieved, it may be left to shift for itself, probably till it is fit for the axe.

In former years the controlling officers had to work with an entirely untrained subordinate staff; but I know from personal observations that the officers turned out by the Dehra Dun Forest School are most carefully taught how to plant; and there is, if the work turns out unsatisfactory, no excuse for them as regards want of knowledge.

All the same a few remarks may, perhaps, not be out of place. The breaking up of the soil either in order to assist natural reproduction or for sowings should be superficial, and should consist merely in the removal of the surface covering and the grass roots. The young deodar plant has a great dislike to freshly turned undecomposed mineral soil and also to half formed humus, but it likes the humus soil found between the roots of herbaceous and grass growth, which should therefore be carefully shaken out and slightly pressed on to the prepared places.

This same remark holds good as regards the preparation of nurseries. The soil should be worked up comparatively shallow, not more than six inches deep, and there should be plenty of good well decomposed humus soil in the composition. It is one of the objections I have to make to basket planting that the narrow long basket usually employed gives an unnatural root development to the deodar, and I have on several occasions observed that with plants of this description the roots bend of their own accord and strike upwards towards the surface soil.

The natural characteristic of the young deodar is a comparatively shallow root-system. It is owing to this that success in its cultivation is confined to fresh soils, and that prolonged dry springs are so particularly fatal to artificial cultivation in the open, but any disregard to this tendency and a vertical or too deep planting of the roots causes more failures than anything else; and it is the mistake most commonly made.

Of course it is advantageous to have big plant holes, but they should be well filled up with good soil, and under no

circumstances should the young deodar, whether planted with its surrounding earth or with naked roots, be planted deeper than its original position in the nursery; and generally speaking the young plant derives more benefit from a broad plant hole filled with good soil than from a deep one.

Owing again to the tender and shallow root-system, any stamping down of the soil is entirely impermissible.*

BERT RIBBENTROP.

15th December 1898.

APPENDIX.

The year 1898 promised to be unusually productive in deodar seed. At Simla nearly all female trees were covered with an abundant crop of cones of excellent growth—a sight to gladden the forester's eyes, and induce him to extend his deodar plantations to the utmost extent his budget would permit. All went well until the middle of July, by which time the cones were most of them rather more than half-grown. It was then noticed that some of the cones were losing their bright fresh colour, and gradually becoming first a bright purple and gradually brown and dead. It was found that each cone so affected had been attacked by an insect, the larvae of which were gradually eating away the whole of the inside. Slowly the pest spread until almost every cone was attacked, and nearly the whole seed crop was destroyed. A number of diseased cones were examined and the larvae collected. They were full grown towards the end of July, at which time they were about one inch long, of a grey green colour, with a brown head. As a rule not more than one caterpillar was found in any one cone, and in a large proportion of the cones, half eaten away perhaps, none were found. Each cone was pierced by a small round hole, and it seems likely that the larvae do not remain in the same cone, but attack fresh ones from time to time. The chrysalis is formed inside the cone, the first one being observed on the 27th August. It is of a burnt sienna colour, about half an inch long. The imago, which proved to be a small brown moth, was first observed on the 16th of September, and from this time on to November, although 500 or 600 cones were plucked and kept under observation, only seven specimens were secured. It is probable that as the cones dry up on being picked, the chrysalides inside them also die. Living in the same cones as the larger larvae, a number of minute white maggots, about $\frac{1}{4}$ inch long, were also observed, and in due time their chrysalides, about twice the size of a pin's head, and the resulting imago, which was a minute fly with greenish elongated body and two wings. These are doubtless Iohneumon, who prey upon the larger insect, which it seems probable is a species of "Phycis." Of these, some deposit their eggs in the ground and the larvae remain there during the winter; of others, the eggs are deposited in the young cones.

Since larvae of varying sizes have been found in the cedar cones, it would seem that the species under notice goes through all changes in the cone. It is probable that the moth which appears from September to November lays its eggs in the still open sheaths of the young female flowers, which close on them when fertilized. The larvae come out in the spring and summer, feed on the cone and complete their course therein. Full information regarding the life-history and habits of this destructive insect has yet to be collected.

In the meantime specimens of it in all stages have been sent to England, where it is hoped that they will be identified. What steps, if any, may be possible to prevent the damage which this insect is capable of doing, is a matter for further inquiry.

FOREST TRAMWAYS IN THE ANDAMANS.

Introduction.—Ever since the extraction of timber from the forests surrounding Port Blair was begun, elephants have been employed in dragging out the logs. For the first few years, when the settlement was but a small collection of houses standing on a recent clearing and virgin forest reached down to its very skirts, dragging by elephants must have been easier and quicker than any other mode of extraction. When the Forest Department took over the working of the local forests twelve or thirteen years ago, the limits of the settlement had been extended, the distances over which timber had to be brought into the station had increased considerably, and elephants had to be supplemented by sling carts. As time went on various methods were contrived with the object of saving the elephants owned by the Department, and of avoiding further outlay on these useful but expensive animals. Buffaloes and sling carts continued to be the best aid, but the carts had to be kept to the main roads of the settlement and were useful only in certain directions. Besides this, the damage done to the roads by the heavily laden carts always entailed a large outlay on road repairs.

In 1890 Mr. E. G. Chester, then Deputy Conservator of the Andamans Forest Division, solved the difficulty of extraction by his idea of introducing a system of tramways into the Division. Mr. Chester rightly judged that the laying of tramways would be far quicker and much cheaper than the making of roads; cheaper also in maintenance; while tramways could be run, practically, in any direction.

The initial cost of the material did not seem prohibitive, and so a mile of tramway was purchased and laid from a tidal creek (the Danikhari) towards a tract of forest then being extensively worked for large timber. The result of the experiment was so eminently satisfactory, that sanction was obtained for the purchase of more tramway, and for more again, until two lines of considerable length were, before many seasons, laid out and in full working order.

The history of these tramways is one of uniform success, but the development of the system was fraught with difficulties at various stages, which had to be carefully studied before they could be overcome. The knowledge thus gradually and laboriously acquired, of the best mode of avoiding initial difficulties and of laying such a system to the greatest advantage, cannot but be useful to officers who may wish to introduce similar systems of tramway into the forests under their charge. This consideration has led to the following notes being compiled. The notes are not to be taken as a scientific dissertation on tramways in general, but merely as an attempt to put in a practical light the experience

gained by the laying of a simple form of tramway through a tropical forest in a somewhat hilly country.

1. *Laying of the Tramway.*—In laying tramways, attention must, in the first instance, be paid to the nature of the produce to be extracted, on which the gauge of the line and the weight of the rails will depend.

Choice of gauge.
A broad gauge is naturally safer against accidents than a narrow gauge, but its use is restricted by considerations of cost both of purchase, and of laying and maintenance; also by its unsuitability to anything but very even ground where the choice of the roadway presents no difficulties. On the other hand, a narrow gauge may be made safe enough for all practical purposes by a little care, while it can be laid at a comparatively small cost through any kind of country—over plain or ridge, or through narrow ravine—and when laid can be kept in repair with far greater ease, and with far less expenditure than a broad gauge line.

2. The weight, otherwise the thickness of the rails to be laid down, will depend entirely on the weight of the timber which it is proposed to truck over a line. But it may be as well to note that unnecessarily heavy rails should never be used, as every additional pound in weight entails so much extra labour for shifting the material of the tramway in the course of laying. Rails of medium thickness and strength appear best suited to the conditions usually obtaining in our Indian (or Burma) forests. Thus the line which has done so much good service in the Andamans is of a two-foot gauge, with rails which weigh only (18) eighteen pounds to the yard.

Iron sleepers are used on account of their handiness, as well as for the stability they give to the line, while they also secure the accuracy of the gauge. Broad wooden sleepers would certainly give the line a firmer foundation, but as will be shown in a later paragraph (No. 5) this one advantage would not compensate for the disadvantages of using wooden sleepers where a line has to be frequently shifted.

A two-foot gauge was the narrowest that could be chosen for use in the Andamans on account of the hilly nature of the country, and the impossibility of avoiding sharp curves round which it would have been too unsafe to truck on a narrower gauge. For the same reason, that is on account of sharp curves, it was seen that trucks going tandem could not well be used for carrying long logs, and in order to distribute the weight of log and single truck over a large surface to prevent a sinking of the line, a not too narrow gauge was adopted.

The two-foot gauge (Greigs' system DD) tried for nearly seven years through wet and dry weather, has so far fulfilled every condition required of it.

Size and weight of the rails.—The weight of the line, namely, (18) eighteen pounds to the yard, combined with the length of the rails, which run up to twenty-one feet, may appear to be almost too great for facility of transport, and some slight inconvenience is certainly experienced in handling the rails; but this size of rail was chosen advisedly owing to the very heavy timber that is extracted from the forests of the Andamans.

It would perhaps be useful to make a general rule that for timber averaging in weight a ton per load, especially on unballasted ways, the lightest line to use should be (15) fifteen pounds to the yard.

The line used in the Andamans, when properly laid, is found to be capable of bearing, without any apparent strain, loads up to three tons in weight. But where it is badly supported, loads which are not of the heaviest, put the rails out of shape at once.

3. To digress for a moment, the use of very light lines is not yet called for in the working of the local forests as there is no extraction of small timber, firewood or of minor produce, worth considering. But should the Forest Department undertake the extraction of firewood, bark, and other light produce for the Settlement of Port Blair, it is believed that a separate system of light tramway will have to be introduced. For such a purpose nothing would be so suitable as the kind of line I have seen in use in the Changa Manga plantations (Punjab), and in the Ruby Mines of Upper Burma. The rails weigh so little that two men can lift a length of double rail, with sleepers attached, and carry it to any point required. The capabilities of the line in bearing weight, as also in standing wear and tear, are great. The line resembles that described in advertisements as:—

Greigs' standard systems of Portable } System A weighing 10, 12, or 14lb
Tramways. } per yard, in lengths of 15 feet.

Greigs' standard systems of Portable } System B weighing 14lb to 18lb per
Tramways. } yard.

and similar systems of John Fowler & Co., Leeds, a firm who export their Portable Tramways to all parts of the world.

4. Ordinarily in India and in parts of Burma, where medium-sized timber chiefly is worked out from the forests, some class of tramway between the 18lb and the lightest classes might be found suitable for the working out of timber and minor produce alike, and prove to be the most economical. But whatever the strength of the rails, it would, I think, be nearly always the most beneficial to keep the gauge to the two-foot. For this gauge, besides the 18lb rails, rails of 14lb or even of 10lb to the yard are always readily procurable.

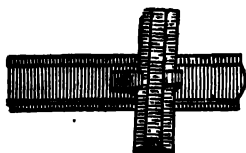
5. *Construction of the line.*—The exact size of the rails and the manner of laying them on the sleepers, and of connecting the

lengths by means of fish-plates, are shown in detail in the diagrams attached to these notes. The sleepers are of iron. The rails are of steel. The attachment of the rail to the sleeper is ingenious but simple.

There is a catch in each end of the sleeper made by a three-sided cut, the piece within being bent upwards towards the middle of the sleeper. Under the catch the



a bolt passed through, as shown in the sketch.



the outer flange of the rail is slipped, and the rail is kept in place there by a clip of iron placed opposite, which holds the inner flange and clamps it down tightly by means of a bolt. The advantages of this simple mode of construction are obvious, and go far to show the superiority of iron over wooden sleepers for a portable tramway. The latter require the fixing of a line once and for all by means of immoveable dog spikes; they

give no guide to the workmen when fixing the gauge of the line and cannot well be used a second time if the line has to be shifted. The use of iron sleepers, on the other hand, ensures the gauge of the line being fixed accurately even by unskilled labourers, enables alterations to be readily made, and, when necessity for shifting a line arises, the sleepers can be very easily detached from the rails by unscrewing the nuts from the bolts, the line moved to any spot required and there relaid with the same sleepers, bolts, and nuts, at a very small cost, without waste of time, and with scarcely any loss of material.

The ends of the rails are joined together by fish-plates, placed on either side of the rails, overlapping the joint and clamped to the rails by bolts passed through. The slots in the fish-plates are longer by half an inch than the diameter of the bolts. This is to give free play to the bolts in a horizontal direction, to allow for the expansion or contraction of the rails in changes of temperature.

In laying the line it has been found advisable to always pull the ends of the rails as far apart as possible when the fish plates have been bolted on. The result is to save the line from becoming crooked in case of any excessive expansion; for supposing the ends of the rails had been touching or very near to each other, if the rails then lengthened much by expansion, they would push each other out of the straight, and the line would become zig-zag.



The bolts through the fish-plates and rails have always to be screwed up very tightly. If this is well done, the joints become the strongest part of the line; but if loosely done, the joints are always apt to get strained, and the ends of the rails displaced. The result might be a very serious upset of a truck.

The manner in which the rails are attached to the sleepers has already been described. Care must be taken to place the sleepers perfectly at right angles to the rails, and then to tighten the bolts which pass through the clips very firmly, so that the sleepers cannot be put out of position by the men or animals that move the trucks over the line. Experience has shown that the sleepers ought not to be placed more than one yard apart. It is of no use, and often a mistake, to put a sleeper under a joint in the rails. As a rule, placing sleepers under the joints should be strictly avoided.

If the road-way is not to be metalled, the iron sleepers require to be assisted to support the line. Billets of wood passed crosswise under the rails will give the additional support needed. But there would not be much use in putting the sleepers themselves at shorter spaces than three feet.

6. *Preparation of the track.*—It is when we come to consider the preparation of the track for laying the tramway that the saving made by adopting a fairly narrow gauge begins to be clearly seen. A broad gauge, apart from the greater cost of the material to be purchased, would entail more road work, more cutting and embankment, the building of larger bridges, heavier metalling, and far greater expenditure on maintenance of the line and of upkeep of the rolling-stock. More motive power would be needed on a broad-gauge to run the trucks over the line.

For a two-foot gauge it has been found sufficient to make the track four (4) feet wide in open country. A little more widening is necessary at corners to give room for regular easy curves, and also on embankments to save the edges of the banks from being pushed down by the men and draught animals that pass along them.

Where labour is plentiful and cheap, it will be found most satisfactory in the long run to make the track wider by two feet or so. But even a six-foot track is after all but a couple of strides in width requiring comparatively little labour for earthwork, and a great deal less expenditure for the building of bridges, for metalling, and for maintenance than would be needed in laying a broad-gauge line.

7. *Alignment of the track.*—The first step in the preparation of the track is the laying of the trace. Very much depends on a proper alignment of the track, as by careful adjustment of the gradient to the ups and downs of the ground to be passed over, the motive power required on the tramway might be reduced to a minimum.

For instance, the general fall of a line should be, if possible, in the direction the trucks will take when laden. Where rises on the outward track cannot be avoided, as steep a fall as possible, consist-

ently with safety, should be given to the part of the line coming immediately before the rise, so that the momentum gathered by the trucks as they travel downwards to the foot may be sufficient to help them up the slope for at least a part of the way. When approaching a curve, a steep gradient should be avoided, as, in going downhill, trucks would be likely to jump the rails at the curve, while when they were being pushed up-hill they would be hard to move with the friction of the curve on the wheels added to their weight.

When a steep fall is necessary as much of it as possible should be thrown into the straight bits of the line, care being taken to gradually lessen the fall before nearing a bend.

The advantage of making all rises on an outward track as gradual as possible to lessen the trouble of passing along laden trucks, even if the line has to be lengthened a little to do so, should be kept in view.

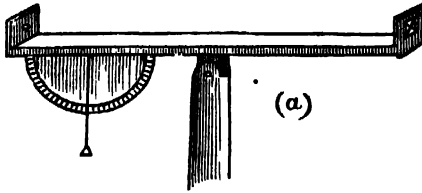
Some of these remarks will appear self-evident and therefore superfluous, but it is as well to note such simple rules for the guidance of Foresters and Forest Guards, who, under certain circumstances, might be entrusted with the laying of a trace.

To run a trace through an intricate bit of country in which the view of all land marks is cut off by dense forest, needs a thorough knowledge of the ground. Much may be gathered from a good map, but only enough to give a general idea of the line to be taken. The respective levels of the starting point and the objective, and any obligatory points that may intervene, should be carefully ascertained on the ground, then a preliminary survey of the proposed line made with some trustworthy instrument with the object of fixing datum points for bridges, etc., and for determining the gradient or gradients to adopt. Not a little trouble is required, as a rule, to fix on points which will fit in with a suitable gradient, and with all the other numerous conditions required by the laws of ordinary road-making. Having got the datum points fixed, working-out details on the intervening ground will be found comparatively easy.

In densely wooded country, where moreover the configuration of the ground is hard to comprehend, the trace needs to be followed by a rough survey by prismatic compass or plane table, to enable the aligner to ascertain his exact position at any time; otherwise he is likely to take a wrong course and find out his mistake only after much time and labour have been wasted.

The simplest instrument to make use of in laying the trace according to a given gradient is a common clinometer, or tracing quadrant. A rough clinometer made of a half round disc of cardboard or thin planking with degrees marked on it, with a plumb line, and with eye holes which are horizontal when the plumb line

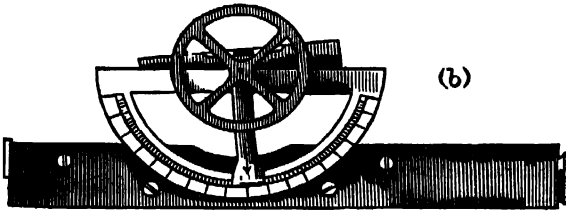
is at zero on the disc, is often good enough for laying a trace(a),



(a)

Such an instrument can be made at any time if required when better instruments are not immediately procurable. But an accurate instrument is absolutely essential where the

line is a long one and the datum points are fixed positions from which no deviations are permissible. A dumpy level might be used with advantage in such cases, but an Abney's level will be found more handy for forest work as it does not hamper a person while pushing through tangled undergrowth or climbing over rough ground, while it is wonderfully accurate for so small and simple an instrument(b). The Abney's level is used in company with a staff,

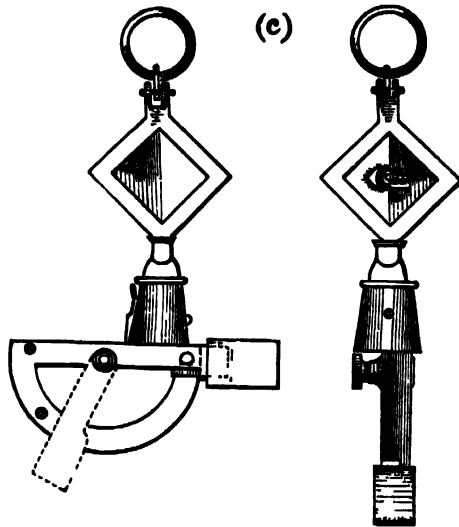


(b)

on which a vane is fixed to the height of the observer's eye. The staff is sent on ahead of the observer who, having adjusted the level to the required angle, stands at the initial point of the trace. The staff is moved in an upright position up or down the slope of the hill until the reflected bubble in the mirror and the vane on the staff appear to the observer to coincide, and to be bisected by the edge of the mirror. A peg is driven in at the foot of the staff. The observer moves forward to the peg and sends on the staff bearer to fix the next station ; and so on. D'Lisle's clinometer is equally

good and is used in the same manner as the Abney's level.(c) Its make, as also that of the Abney's level is shown in the illustrations in the margin.

The principle of D'Lisle's clinometer is an ingenious arrangement of a graduated arc with two radial bars, one light, the other weighted. Above the arc, and at right angles to the cord which subtends it, is a reflecting mirror; the whole being suspended by a ring. By adjustment of the bars, the reflecting mirror, in which (as in the Abney's level)



the image of the advanced vane has to be sighted, is made to incline from the perpendicular at any angle so as to correspond to any given gradient. Special levelling instruments might be used with good results on works covering long distances and requiring great accuracy, but there are few that are not too bulky, or too slow of adjustment for ordinary forest work.

The following table of angles and elevations will be found useful :—

Angle.	Inclination.	Elevation per mile.
1°	1 in 115	46 feet.
2°	1 " 76	69 "
3°	1 " 57	93 "
4°	1 " 38	128 "
5°	1 " 29	154 "
6°	1 " 23	181 "
7°	1 " 19	217 "
8°	1 " 14	269 "
9°	1 " 11	342 "

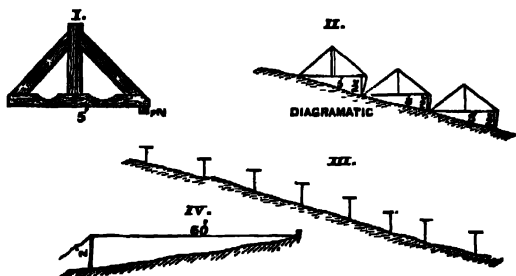
More convenient for simple calculation will be found the following table of gradients :—

1 in 100	corresponds to a rise of about	0° 40'
2 " 100	" " "	1° 9'
3 " 100	" " "	1° 18'
4 " 100	" " "	2° 18'
5 " 100	" " "	2° 55'
6 " 100	" " "	3° 27'
7 " 100	" " "	4°
8 " 100	" " "	4° 35'

In concert with the laying of the trace, comes the pegging out of the line of tramway to show road centre, drains, height of embankments, and depth of cuttings. This has to be carefully and completely done, especially if the cutting of the track is to be left in the hands of unskilled labourers without trained officers to guide them. Not only the centre but the side widths of the road should invariably be pegged out distinctly. Profiles should be erected wherever embankments are to be made to guide the workmen.

All Forest Officers must have a fair knowledge of road-making, and it would be useless to lengthen these notes by describing here, in detail, the procedure to follow from the last named stage to the completion of the road-way. But some simple rules and formulae taken from treatises on road-making, and a few facts learned by long experience, might be found useful to refer to, and are therefore introduced in the following paragraphs.

The trace having been laid, unskilled labourers might be made to follow it up accurately by constantly checking their gradients with such simple contrivances as the following :—

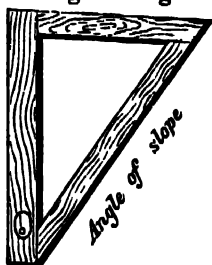


I and II. *The Mason's level.*—The base of this instrument is kept horizontal by watching the plumb line which swings from its apex, and the fall of the road then determined by means of the graduated leg at one end. In the drawing, for instance, the base of the instrument being 5' and the length of the leg 2', the gradient it fixes is 1 in 80.

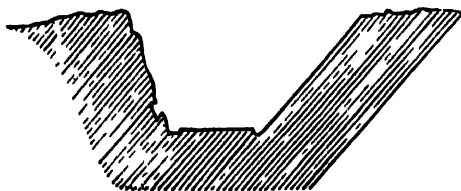
III *The T or boning staff.*—This is useful for carrying on a gradient which has been started by a levelling instrument. It is simply a short staff with a cross head. Three or four staves of equal length are placed upright at intervals along the trace. The second and following staves are lowered or raised until the cross pieces are in line, and show a slope from one to the other corresponding to the gradient of the road. The bases of the staves then indicate the road level. The first staff is next moved to a point beyond the last and raised or lowered into line, a peg being driven in at the foot of it to show the road level where it stands. This process is repeated until all the levels along the projected roadway have been laid out.

IV. Simplest of all, although not very accurate, is the staff with a string of proportionate length, which, when nothing better can be had, is a tolerably fair check on the rise or fall of a road.

In making cuttings or embankments a *plummet* is always required for guiding coolies in cutting the slope to a given angle. It consists of a triangular frame-work of wood, one side of which is kept vertical by means of the plumb which hangs within it, and the hypotenuse or lower side, which is purposely made to the required angle, is laid against the slope from point to point to check it.



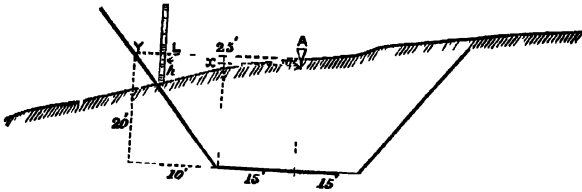
Where cutting and embankment have to be done, it is useful to remember that the most common earth slopes (otherwise the natural angles of repose of different kinds of earth in a dry state) are from $1\frac{1}{2}$ in 1 to 2 in 1. In stratified earth, a greater slope must be given to that side of a cutting which runs most parallel to the stratification, but on the opposite side a saving of labour may be effected by leaving the slope fairly steep.



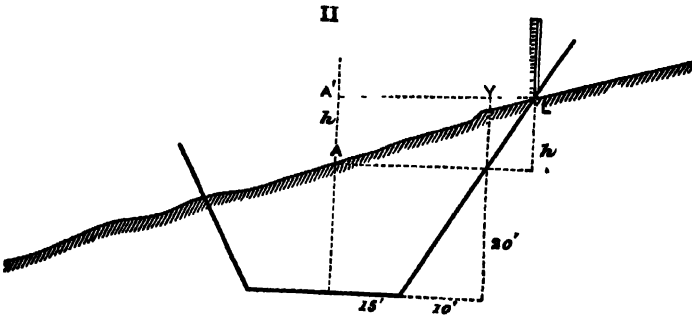
It is important in beginning heavy earthwork to know exactly where to commence cutting or embanking so as to avoid wasting time and labour. Figures

I and II in the margin show the way of ascertaining where to commence a cutting on an uneven surface, and figure III where to begin the foot of an embankment under similar conditions.

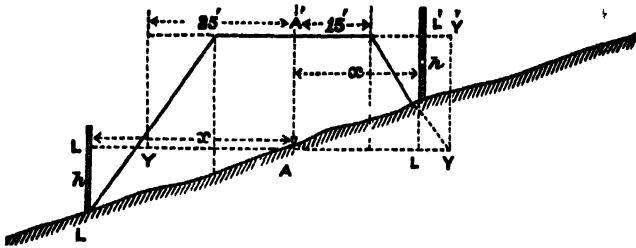
I



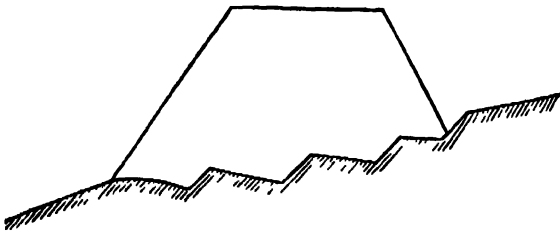
II



III



IV



An example will make these diagrams clear. To take convenient figures, suppose the road to be 30' wide, the depth of cutting 20' (or the height of embankment 20') and the angle of the slopes to be 2 in 1.

The centre peg A being laid, the side widths will be 15'.

I. In the first figure the distance x from centre of road to the point L where the cutting is to be begun is = to 25' — LY. By similar triangles LY : h :: 10 : 20 that is :: 1 : 2.

Stretch a 25' tape line from A horizontally, and pass a levelling staff vertically along it until the proportion of 1 : 2 between tape line and staff is obtained. Where the staff then stands the cutting is to be begun.

II. In the second figure YL is found by the proportion it bears to h , which in this case is 1 : 2. Then L is found by measuring horizontally from the staff standing on A the distance 25 + YL.

III. s being the distance from A to levelling staff:

On the lower side,

$$LY \text{ or } s-25 : h :: 1 : 2$$

On the upper side,

$$s-15$$

$$1 : 2.$$

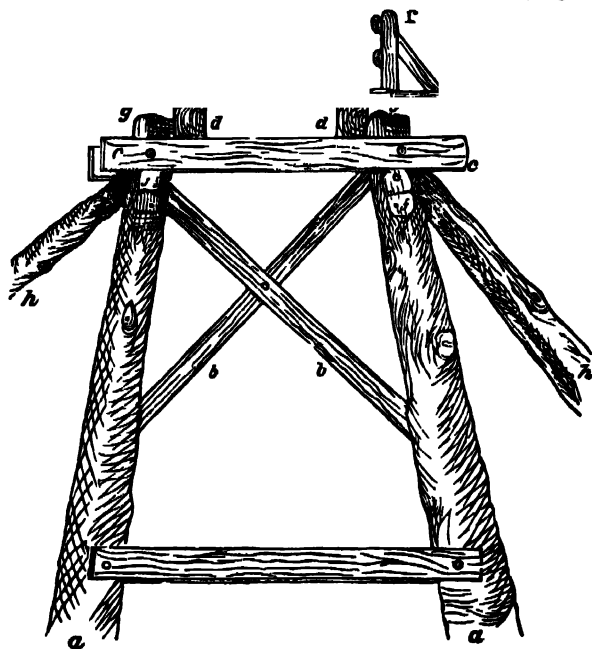
In laying off the side width of the base on the upper side, stretch a tape line from A' horizontally and move the levelling staff up or down the slope until A'L' — 15' (side width) is to 4 :: 1 : 2 and then begin foot of embankment from the point where the staff stands.

On the lower side the procedure would be similar, the tape being stretched horizontally from the peg A to the levelling staff, until the excess number of feet on the tape over 25 bore to the staff at the level of the tape the proportion of 1 : 2.

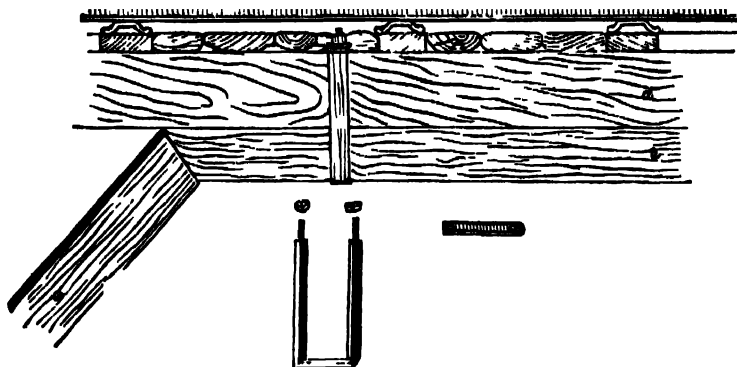
In the case of raising embankments on a slope, before starting work, the ground should be stepped to prevent the embankment slipping (IV).

Bridges.

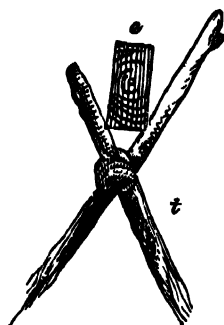
8. The bridges on the Andamans forest tramways are of the simplest construction, although in many cases they are thrown across deep ravines of considerable width. Strong uprights, *s s*,



made of long sound logs from the forest, are planted on either side of streams (or ravines) or at intervals in their beds, each pair being joined together by trestles *b b*. Cross girders are bolted to the posts at the required height, *c c*, and over them longitudinal beams *d d*, squared by the axe, are placed, stretching over several pairs of



posts, or from one pair to the next. Where the span is greater than twelve feet, the longitudinal beams are further supported by struts, *e e* (second figure). The cross girders are made more stable by nailing brackets, *f. f*, under them to the uprights. Over the



longitudinal pieces, sleepers are placed crosswise to form a bearing surface for the rails of the tramway, *g g*.

In high bridges the uprights are given an outward slant to widen the base of the bridge, but in addition they are always held up on the sides by props, *A A*, which prevent the bridges from swinging. The dimensions of the girders are made proportionate to the span they are meant to cross, but usually the cross girders, which are always used in pairs on opposite sides of the uprights, are about 15" x 3", and the longitudinal beams 14" x 7". The bridges made of timber of these dimensions easily bear the weight of two laden trucks, equal to four or five tons. The great weight of the longitudinal pieces makes it a difficult matter to lift them into place, but by the help of trestles (*t*) made out of long stout poles, girders up to half a ton in weight can be lifted across a span of 15 to 20 feet.

It is advisable to remove the bark, and, if possible, the sap wood from all timbers used in the construction of bridges, and then to tar the bridges over liberally. With these precautions the bridges will be found to last twice as long as when left exposed to the weather and to the attacks of beetles.

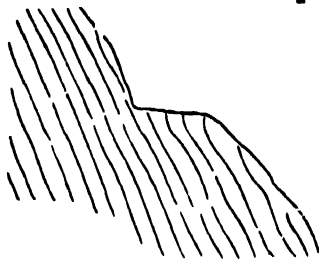
8A. On high bridges, or on those of unavoidably delicate structure, the running of trucks needs to be strictly regulated to prevent the bridges receiving an injurious shock by the jolting of the trucks, or undue strains from the passing over of more than one truck at a time. When a heavily laden truck has been quietly brought to one end of a bridge of this kind, it should be evenly but quickly taken across, so that no part of the structure has time to feel the weight of the load. Native labourers can never be made to understand the reasons for such precautions being taken, and it is always advisable to lay down rules to ensure proper care being taken when necessary.

To save accidents to passengers and to draught animals, hand-rails of some kind are essential on high bridges. A simple way of putting up hand-rails is shown in the accompanying section of a common bridge (*r r*).

Bridges ought always to be numbered. This system makes reference to any bridge or to any portion of a line which may be in need of repairs, easy and readily intelligible, so that when an inspecting officer records in his notes that bridge number so and so requires new cross girders, for instance, the road-overseer is able to at once make his arrangements for carrying the order out.

9. *Drains*.—Drains are a very important consideration in finishing a road-way, as well as in keeping it in good order. The road may be made to drain itself to a great extent, by giving it a

slight outward slant wherever possible. But where rails are



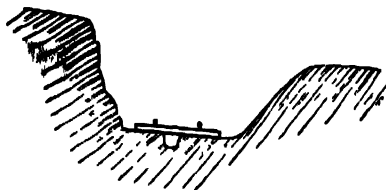
to be laid, it must be remembered that the outside of a curve has always to be somewhat raised. A broad and fairly deep inside drain, from which cross drains branch at frequent intervals, is one of the best ways of

keeping a road dry on a hill-side. The inside drain, however, will not do where the stratification is in a direction which is likely to induce land slips, or it must be so cut, and then paved, that percolation of the water towards the outside of the hill is prevented. On the flat, drains on both sides of a track are of course absolutely necessary. In this case the centre of the road needs to be well raised. Cross drains are essential, but the usual rule of throwing culverts over them seems less preferable than spanning them by small open bridges.



In cuttings, side drains have long been given up in the Andamans, in favour of centre drains which run between the rails of the line and below the sleepers. This system has been found

to be far cleaner, and it allows of a cutting being made much narrower, than if there were two side drains, thus saving much labour and time in the preparation of the track. Fascines are nearly always used for holding up unstable slopes, and have been found very satisfactory both as regards their effectiveness and the comparatively slight cost of building them up. Stone revetments would be perma-



uent, but suitable stone is not always to be had near a line, whereas poles and brush-wood are always available at any point in these forests.

10. *Metalling.*—Metalling is not essential on a tramway over which the trucks are moved by bare-footed men, but it is always desirable for the sake of improving drainage, for facilitating work, and lessening the cost of maintenance of the line. Most of our forests being in hilly country, stone is generally available all along a line, and the metalling need not be expensive specially when it is considered how narrow a truck has to be covered. If stone is not to be had, lumps of clay, burnt on the spot to the hardness of bricks, form a very good substitute. In low wet situations, a layer of sand on the road-way is a sure corrective of muddiness; and, as long as the sand is permeated by moisture, it keeps nearly as firm a surface as metal.

Where buffaloes or bullocks are to be used for draught purposes, metalling of the road-way must be carried out and done thoroughly. The metal needs but to be roughly laid in large pieces, but it must be well rammed, the surface being strewn with gravel or sand in the process, to form a bond.

11. *Laying of the line.*—It may be assumed that in most cases where tramways are to be laid through or to a forest, none but unskilled labourers will be found to do the work. It will not be out of place therefore to continue noting the simple practical methods adopted in these Islands to ensure something like uniformity of gauge, and, generally speaking, the trueness of the line, being obtained.

The rails are laid, to begin with, at the initial point of the line, so that all material can be carried forward on a truck as the laying progresses. One rail only is laid at a time. When the single rail has been inspected, and approved of, or the needful corrections made to levels and curves, the sleepers are squared, and the companion rail let into them. The object of this method is to avoid the narrowing of the gauge that would inevitably ensue if two rails were laid down at once, a correction found necessary, and the curve then altered. The result would be that at such points, the trucks would ever after be liable to jump the rails and upset.

Each rail as it is laid should be pulled out at the joint with the last rail, as far as the slots in the fish-plates allow (as already explained in paragraph 5), to prevent the possibility of the line getting crooked through expansion in hot weather.

The joints of the right and of the left rails should never be opposite to each other. The bending of the rails requires to be done away from the joints as much as possible. If a joint must be bent to preserve regularity in a curve, the fish-plates should be

beaten to shape first and then clamped to the bended ends of the rails.

Where a rail has to be curved, the rail bender should be applied at every 9" or 12", producing at each point an almost imperceptible bend, but along the whole rail a decided regular curve. Unskilled labourers, left to themselves, are apt to make sudden sharp bends at long intervals, and so to give the line the appearance of running round a series of crooked corners. The bending of rails on bridges is dangerous to the traffic that passes over them, as well as wearing to the structure of the bridges themselves.

Sleepers should not be laid under joints in the rails as their support is not needed there. It is, moreover, impossible to bolt the clips down to the sleepers properly owing to the fish-plates being in the way.

As soon as the sleepers are laid down they should be packed with stones. This is always necessary, but particularly so on an unmetalled track. The packing is done by means of rammers and packing hammers. In doing the packing, coolies are most liable to earth up under the rails as well as under the sleepers, and thus to encourage rain water to lodge between the rails and form puddles. This tendency should not be forgotten, and the labourers should be warned against indulging in it. As an additional precaution, the men engaged in packing should be made to run small cross drains between the sleepers and leading out under the rails. This operation ensures speedy and complete drainage off the line into the side drains.

Besides packing under the sleepers, much additional stability can be given to a line on an unmetalled track by laying billets of wood under the rails alternately with the sleepers. Where puddles exist or the ground is naturally wet, or soft, such billets, if used in large numbers under the rails so as to form a corduroyed bearing surface, very nearly serve the purpose of solid metalling.

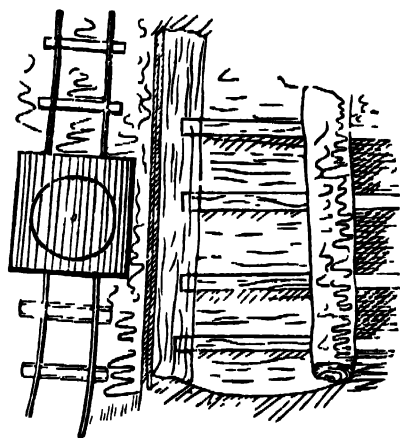
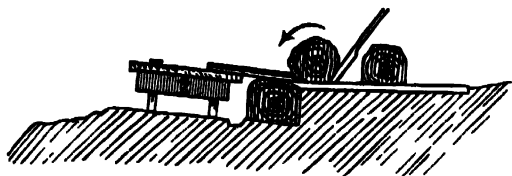
12. At every mile or mile and a half along a line, sidings are necessary to allow of trucks and trollies passing each other. The best situation for sidings is generally where the junction of a dragging path or cart-road with the tramway, makes it necessary to form a dépôt. This arrangement facilitates work by enabling the loading of trucks to be done off the main line, which is then always open to traffic.

The dépôts in this Division are made in the form of platforms on an exact level with the trucks. The trucks come alongside of the platforms, have a log rolled on to them, and pass on, without any trouble or delay. The platforms are simply levelled earth with a squared log of some common wood placed on the outer edge. In wet weather the platform may become very soft and muddy. In such case a few long common logs from the forest are laid like

skids from the edge of the platform inwards to form an easy slip for the logs that are to be trucked out.

Loop lines, instead of sidings, are usually laid at either terminus of a tramway on account of the larger number of trucks, laden

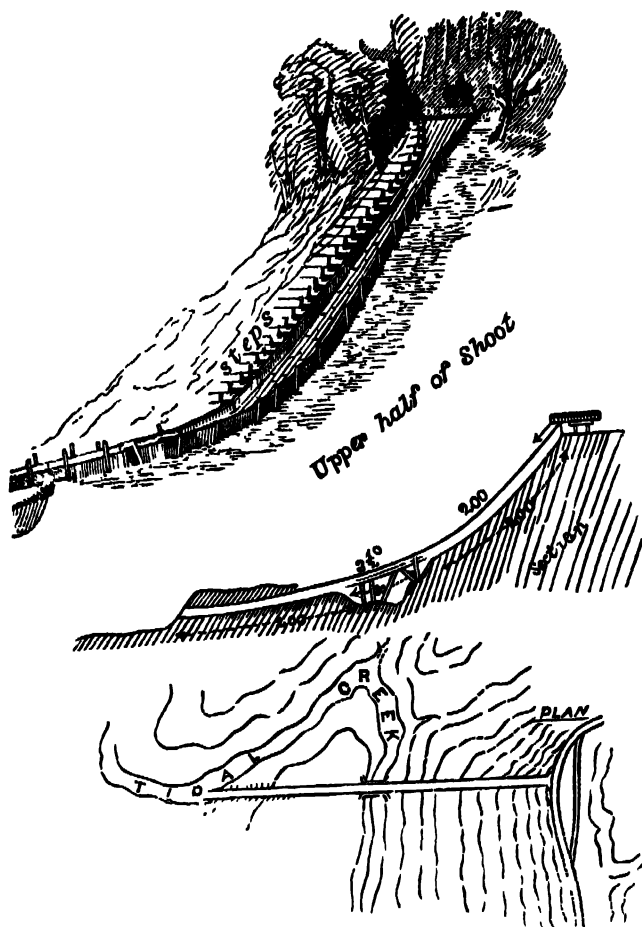
and unladen, that pass in and out at nearly every hour of the day. In putting down a loop line, it should be given a length corresponding to the largest number of loaded trucks that is ever likely to be shunted on to it.



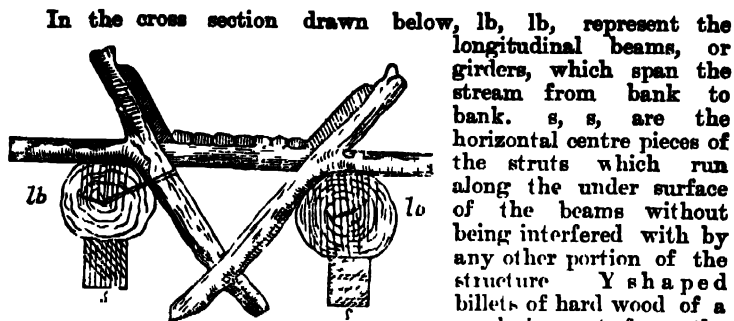
At the termini some attention has to be paid to the placing of the platforms in order that the trucks which come in or are to go out, might deposit their loads, or take logs on board without the risk of confusion or delay.

In the Andamans, logs for export are trucked to sidings by the waters' edge, or immediately above it, and slid off the trucks to begin their watery journey to the sale depôts without any loss of time.

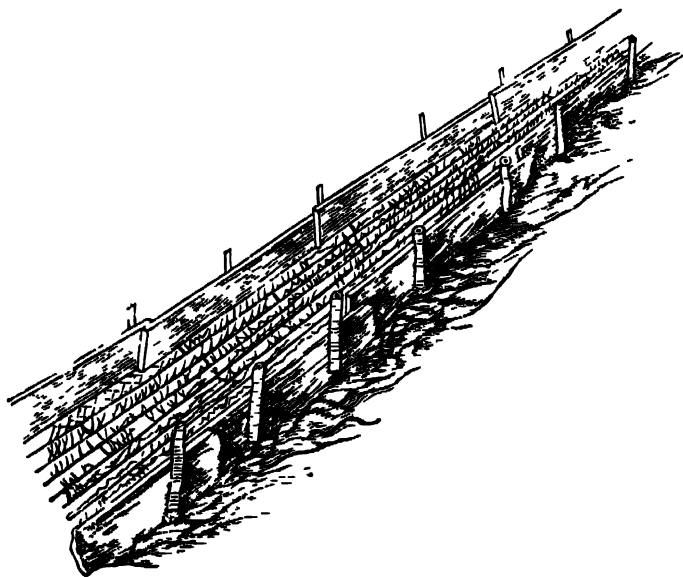
At the lower terminus of the last tramway which has been laid, a special shoot has been constructed down which logs are shot direct off the trucks into a creek 80 feet below the level of the tramway, and 160 yards from it. This shoot is worth a short description.



13. The rough sketch of the upper portion of the slide in the margin gives an idea of its general appearance. The section and plan will serve to illustrate the details of the ground over which the slide is carried. It will be observed that one portion of the slide is taken, by a long bridge over the stream into which, at a lower point where the water is deep, the logs are shot. The length of this bridge is about 70 feet and the width of the largest span about 30'. The manner in which the frame-work of the slide was constructed on the bridge so as to leave the underside of the longitudinal beams free for strutting (the strutting being done at a later period), is interesting, and shows how much can be done with the rough material available in a forest, independently of professional (Engineering) guidance, and of the assistance of skilled artisans.



neighbouring forest, are laid over, and inside of, the beams in pairs, and are nailed down to the beams as shown in the sketch. To give greater stiffness, the stems of each pair of Ys are also nailed to one another. A series of such pairs placed at intervals of 4 feet to 6 feet along the beams across the bridge, forms a cradle, looking like the ribs of a long boat. Side by side with each pair of Ys is a sleeper lying athwart the beams. The rest of the structure is simple. Round billets are laid longitudinally on the sleepers and nailed down to form the bed of the slide, and slabs are laid against the upper arms of the Ys on either hand to form the side.



Each slab and each billet slightly overlaps the one below it, like the shingles on a roof, to prevent the logs catching anywhere as they shoot down the slide. The advantage of the design is that any piece which is worn out can be replaced in a few minutes without interfering with the rest of the structure. The slope of the slide has proved eminently successful. It is steep at first having an angle of 20° with the horizon, has a slight check just above the bridge which arrests the pace of the shooting log and saves the bridge from receiving an undue shock; and below the bridge it begins to assume a slighter and slighter decline; ending almost horizontally at the waters' edge. The logs all run through and seldom fail to pull up a bit at the water side. Here the bed of the shoot is tilted to give the logs a sideward roll (the lower side being left open) as they slide into the tide, so that no log remains directly in the line of the shoot to block the way of the logs that follow.

14. *Preservation of the line.*—Constant use keeps the rails and sleepers in a fair state of preservation, but in order to check deterioration it is advisable to periodically clean and tar the iron. The iron should be well heated, scaled until all the rust on it has been removed, and then smeared with hot tar.

A line should be well protected at all crossings where it is not possible to prevent elephants and buffaloes dragging logs across the line, or carts passing over it. The rails can be saved by baulks of wood being buried firmly along side of them. If the baulks are made of hard wood and stand slightly higher than the rails, they can save the latter altogether from being bent or shifted, by the heavy logs that are dragged across the line.



15. *Gradients.*—The following remarks must be considered to apply to lines over which very heavy timber, weighing from one to three tons, is carried on trucks, which themselves weigh about half a ton. Where light material on light trucks has to be carried over a line, the question of gradient assumes quite a different aspect, and much steeper gradients would be allowable.

On hill tramways, experience points to a gradient of 2 in 100 ($1^\circ 9'$) as the most economical. To exceed this means to greatly increase the motive power required for taking trucks up the line, and makes it troublesome to regulate the pace of trucks going down. A slighter gradient than 2 in 100 is scarcely appreciable on soft (or non-solidified) lines, and needs no comment.

But the natural obstacles to be overcome in laying a line, seldom allow of the most economical gradients being chosen. As often as not a certain height has to be reached within a prescribed distance, requiring a steeper gradient than is actually convenient. The safest gradient has then to be considered rather than the most economical.

In the Andamans, when working down-hill without brakes, loaded trucks are often taken down gradients of 1 to 2 in 100 ($0^{\circ}40'$ to $1^{\circ}9'$). With good brakes, it is found that heavily laden trucks can be taken down an incline of 1 ($2^{\circ}18'$) or even 5 ($2^{\circ}55'$) in 100, without much risk. The most desirable gradient for down-hill work is 2 in 100. It is just sufficient to keep the trucks moving gently downwards by themselves, while they can be held under perfect control by a single brakeman. For down-hill work the gradient should in no case be allowed to exceed 3 in 100 ($1^{\circ}13'$) without specially powerful brakes.

A very powerful brake of simple design was invented by Mr. C. Dingwall-Fordyce, late Deputy Conservator of Forests, Andamans, with the help of which loaded trucks used to be kept under control down a gradient of 4 or even 5 in 100 for short distances. But trucking under these conditions was always nervous work. A drawing of the brake is given with the note on rolling stock (para. 17).

For up-hill work, $1\frac{1}{2}$ to 2 in 100 is a convenient gradient, as it does not greatly increase the weight of the trucks that travel up the line, while the incline is sufficient to allow of the line rising at the rate of 100 feet in a mile. 3 in 100 ($1^{\circ}13'$) is the steepest gradient up which coolies can be expected to push heavily, or even lightly laden trucks. A steeper gradient, up to 5 in 100 ($2^{\circ}55'$), has been found to be just within the capability of buffaloes at the rate of one animal to a truck carrying one ton. This does not argue that with a lighter load a steeper gradient would be permissible. Even the 3 in 100 gradient is likely to kill the buffaloes by overstraining them, and is moreover dangerous to life when passing trucks, empty or otherwise, down the line.

Thus it will be seen that for taking laden trucks (one to three tons) down-hill the best gradient is from 1 to 2 in 100; the maximum is from $2\frac{1}{2}$ to 3 in 100. Slightly steeper gradients are allowable for short distances.

The maximum gradient for up-hill work ought to be fixed at 3 in 100, and the most economical at 2 in 100.

Modifications of these rules might be accepted under special conditions relating to the state of the road-way, the number and sharpness of the curves in the line, or the nature of the loads to be carried over it.

16. *Curves*.—It is hard to lay down any very strict rules about curves, as with the width of the gauge the kind of truck used, and

the nature of the load, varies the sharpness of the curve over which it might be possible to work with safety. It is assumed that timber trucks are made on rigid frames which give no play to the axles of the wheels, bogeywise. The axles are fixed to the frames of the trucks parallel to each other and about $2\frac{1}{2}$ feet apart. For trucks of this description it is laid down that, with a two-foot gauge, curves having a radius of 10 feet can be worked over. But however possible this might be with trucks when a bogey is attached to them and free play given to the leading pair of wheels, it is quite impossible to run an ordinary truck, with axle rigidly fixed, round a curve with a shorter radius than 18 feet. This is especially the case when the load is a heavy one, or one that is not well balanced. In the event of two trucks being used to carry very long logs, without the help of bogeys, the smallest curve that could be adopted with economy might be laid down as an arc with a radius of 25 feet. The disadvantages of having very sharp curves need not be dilated on the inevitable strain on the motive power; and the wear and tear of both rails and trucks, being easily understood, not to mention the risk of derailments of trucks.

In the Andamans, experience points to a curve having a radius of 30 feet as the sharpest that can be adopted consistently with smooth and economical working. In general, far more gradual curves are laid, even at the sacrifice of an easier gradient, or in spite of what may necessarily be greater initial expense. An arc described with a radius of about 50 feet is found to be the most convenient, as being passable for any manner of truck, single or tandem, with bogeys or without, no matter what the nature of the load; while adding very little more than sharp and impracticable curves do, to the length of a line. More gradual curves, where a turning has to be made, would be wasteful by increasing distances unnecessarily.

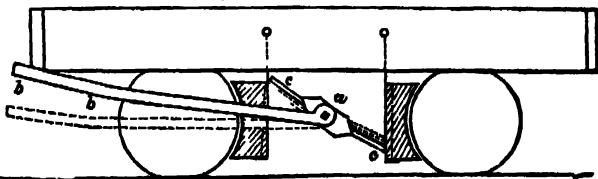
The outer rail in every curve, no matter how gradual, must always be slightly raised. In the Andamans the extent of this raising is not regulated by any formula, but merely done by eye. A slightly greater tilt is given to the outer rail, the quicker the curve, and the safety of the line is assured by trial.

17. *Rolling-stock*.—Owing to the nature of the loads that have to be carried, the trucks in use on the Andamans Forest trainways are of heavy build, being designed entirely with a view to giving them great bearing power. An ordinary timber truck weighs about half a ton itself, and is capable of carrying a load of two and-a-half tons without any apparent strain. As will appear from the accompanying diagrams, the construction of the trucks is extremely simple, being merely that of a strong wooden frame held together by means of two iron tie rods, with a wooden platform fixed on the top. To the lower part of the frame two bushes are bolted, and in these the axles of the wheels revolve as the truck moves onward. The bushes are fitted with under hanging caps to hold the oil required for the lubrication of the axles. Other fittings in the

way of hooks and rings are attached to various parts of the frame. On the platform is a circular ring of flat iron, and in the centre of the platform a hole for receiving the leg of an iron frame that might be called a "basket". The frame pivots on the hole and rotates on the ring. It is meant for holding the ends of long logs when two trucks have to be employed to carry a single piece of timber, and are constantly getting out of line at the curves of the tramway. This contrivance is the more necessary as the trucks are bogeyless.

Each truck is also fitted with a brake, either with single or double action. The single action brake is a primitive contrivance. Its make and action are fully explained in the diagrams attached to these notes. The double action brake is an invention of Mr. C. Dingwall Fordyce, Deputy Conservator of Forests, and is used in the following manner. The various parts of the brake and the manner of its action will be better understood by reference to the diagrams, which have been carefully drawn to scale.

The principle of the brake is a *jam*. The idea is carried out simply and very effectively by placing a cross bar (c) obliquely between the two blocks which face respectively the fore and after wheel on one side of the truck. The bar in its oblique position touches lightly on either block as it hangs free of the wheel, c. c. Rigidly fixed to the same axis a, as the one on which the cross-bar is placed, is the handle of the brake (b b). Pressing the handle



downwards tends to bring the cross-bar to a horizontal position in which it takes up more space, as shown by the dotted line in the diagram, thereby shoving either block outwards against the wheel which it faces. The harder the handle is pressed, the tighter does the cross-bar jam the blocks against the wheels, until neither wheel can turn. To get an even pressure on the wheels the cross-bar is given a little play by the slot through which its axle pin passes being made a quarter of an inch longer than the diameter of the pin.



Besides large trucks for carrying heavy timber, a tramway should always have lighter trucks for the carriage of firewood, scantling, or other light produce. Such trucks should be provided with a superstructure fashioned to hold loose material together when necessary, and to be removed when not required (fig. 5 in sheet of illustrations).

There should also invariably be at least two light hand trollies on every tramway for purposes of inspection. An inspecting officer can do a great deal by riding on his trolley with his eyes fixed on the rails, and a piece of chalk in his hand to mark every defect in the line which he may notice as he passes along. The road overseer following with his gang of workmen puts in order each defective part as he catches sight of the chalk marks ; and soon all conspicuous irregularities in the line disappear.

Trollies should be made with removable platforms (fig. 6). So that when a trolley meets trucks, the trolley can be taken off the line in pieces, carried round the trucks, and put together again on the further side. A glance at figure 6 in the diagrams will show that comfort can be combined with simplicity of structure and lightness, if a little care is exercised in carrying out the design of the trolley.

Workmen ought on no account to be permitted to overturn a truck, even although it may be unladen, either to let an officer's trolley pass or for any other reason, as the flanges of the wheels or some other part of the truck would very likely be strained, or broken, in doing so. Working trucks that have to pass each other can, with a little management, be always made to meet near a siding where one lot of trucks can be switched aside and kept waiting until the other lot rolls past.

18. *The load.*—The load depends on several considerations, such as :—

1. Nature of demand.
2. Maximum gradient.
3. The curves in the line.
4. And the motive power available.

The last three considerations must naturally be made subordinate to the first, but although everything possible should be done to make a line suitable for bringing out the kind of timber in demand, it is often impossible to avoid steep gradients or sharp turns on a hill tramway.

When this is the case, the weight of the load, and secondly its length, have to be carefully considered. It has been noted elsewhere that exceptionally heavy timber is brought out of the Andamans forests, and that the line selected was of a kind capable of bearing continuous heavy traffic.

On the question of load in relation to gradient, it is safe to say that on our steepest down-hill gradients, which lie between 3 and 4 in 100, with good brakes, a load of one and-a-half ($1\frac{1}{2}$) tons may be run down under perfect control. Logs of one ton measurement and of a length not exceeding eighteen (18') feet, are found to be the most economical to truck out when manual labour is employed

as the motive power, being neither too heavy for controlling down-hill, nor for moving up-hill. These remarks are made relative to the local practice of allowing four (4) men to a truck.

On a level line, with men to move the trucks, the most economical load would be about one and-a-half ($1\frac{1}{2}$) tons.

By using draught animals like buffaloes, still heavier loads can be transported over fairly level lines, or up-hill. Indeed over moderately easy slopes, whether up-hill or down, draught animals with heavier loads behind them than men can work, are the best kind of motive power to employ. But it has always to be remembered that buffaloes and bullocks can exercise no backward pressure on trucks travelling down-hill, and that the whole control of the trucks rests with the brakeman. For this reason, very heavily laden trucks should not be drawn by animals where there are many steep descents in a line.

The maximum load to trust a truck with, going down a gradient of 3 in 100 ($1^{\circ}13'$) is one and-a-half tons by measurement or about two tons by weight.

On up-hill gradients the load needs not so much to be limited by considerations of safety, as by the extent of motive power called for in transporting heavy timber.

In carrying long timber over a line, attention must be given to balancing the timber very carefully on the truck. The centre of gravity of the log should be thrown slightly ahead of the middle of the truck to prevent the front wheels jumping off the line in case the truck is inclined to rock. This rule might be laid down as a general one for short as well as long logs.

Where curves in the line are sudden or very sharp, the carriage of long logs is always risky, and ought properly to be done on two trucks going tandem and running on bogeys. There are no bogey trucks in the Andamans yet, and much care is often necessary in negotiating the curves on our lines. However, by insisting on trucks being moved only at a walking pace, accidents have hitherto been avoided.

19. *Motive power.*—Traction by steam engines has not been tried in the Andamans yet, but that it would be better than any other kind of motive power can scarcely be doubted; the only condition of success being that easy and uniform gradients (such as are generally to be found on the local tramways) must be adhered to.

Draught animals or workmen (convicts in the Andamans, coolies elsewhere) are each best according as the line is either level or up-hill, or steep down-hill. In the latter case, the reason for manual labour being preferable, is that four men to a truck can keep it under far better control, than the one brakeman on a truck drawn by an animal, when the brakeman has not only to look after the brake but to guide his animal at the same time.

In the former case for transport on the level, or up-hill, draught animals (especially buffaloes) are unquestionably superior to coolies for hauling the trucks, as a single buffalo with one brakeman can drag two laden trucks easily, thus doing the work of eight men, or, to speak more correctly, thereby saving seven men on every two trucks.

In choosing between men and draught animals, it must not be forgotten that there is more initial expense in laying a line for animals to work over as it must be well metalled, and the cost of maintenance of the road must necessarily be greater than when bare-footed coolies push the trucks.

Whatever the motive power, it is advisable to always work as many trucks as possible together, with the object of the men on the several trucks being able to combine and together load each truck in succession.

This consideration is the more important on lines on which there are several depôts, as it would be too costly to employ cranes, or other expensive machines, for loading the trucks, at more than one or two stations.

20. *The old wooden tramway.*—Before steel tramways were introduced by Mr. Chester, he laid a long line of wooden rails in an open level valley called "Anikhet," where at that time a considerable amount of timber lay scattered about the clearings made for cultivation.

The object of the tramway was to bring out this timber as quickly as possible in order that the clearings might be burnt over before being put under the plough. The tramway answered perfectly the purpose for which it was laid down. Its construction is therefore deserving of notice.

The rails were laid 2' apart and were made of Pyimma wood (*Lagerstroemia-hypoleuca*) which proved to be the best that could be found for withstanding the wear and tear of the heavy trucks run over the line, and was moreover well suited for laying round curves, as it could be easily bent after being steamed. The sleepers were made of any hard wood whatever, and laid 3' apart. The rails were fastened to them by 8" nails driven through until the heads of the nails were buried half-an-inch below the surface of the rails.

The dimensions of the sleepers were 5' x 5" x 3", and of the rails about 3" wide x 4" deep, and about 12 to 15' in length.

It is likely that some expenditure and time would have been saved in repairing the line, if *shorter* lengths of rail had been used, as renewing worn portions of the line would have been easier, with shorter lengths to be lifted up and replaced, and less steaming and bending of rails at the curves would have been required.

The trucks used on the wooden tramway were similar in construction to those purchased with the steel tramway (paragraph No. 17), with the difference that in the case of the former the flanges of the wheels had to be made about 3" deep to give them a better chance of biting the wooden rails.

The casting of the wheels and bushes, and the building of the trucks, were carried out locally at a comparatively small cost.

These locally made trucks are still running on iron rails, and after six years of very rough usage they still keep in very fair order. But owing to the depth of the flanges, the wheels of the locally manufactured trucks jam all the sleeper bolts of the imported line and render the bolts useless for relaying the line.

On this account the trucks are not generally used, but have to be restricted to certain portions of the tramways where injury to the sleeper-bolts is of no consequence.

In 1892 Mr. C. Dingwall Fordyce renewed a certain length of the wooden tramway at a trifling cost, and brought a very large portion of the scattered timber in the Annikhet valley over it to sale depôts. But owing to the large demand for timber for the Europe market, labour being scarce the tramway had to be again abandoned.

FINANCIAL AND PRACTICAL ADVANTAGES.

21. *Cost of laying and of maintenance, and working expenses.*—For convenience of reference it is necessary to quote a few figures relating to the cost of importation of tramway material, and the expenses connected with laying, maintenance, and working of the line—from Mr. F. G. Chester's Annual Report for the year 1890-91, and from Mr. C. G. Dingwall Fordyce's Report for the year 1892-93.

Mr. Chester says. "The purchase of the tramway alluded to in last year's report was sanctioned * * * * the material consisting of one and-a-half (1½) miles of Fowler's Patent System Cast Iron Portable Railway, 24" gauge with steel rails weighing 18½ per yard and trough section sleepers, was received, the cost, including that of 10 trucks, switch crossings, and tools for laying, amounting to £14,725."

Note.—This amount includes steamer freight from Calcutta to Port Blair, as well as shipping charges at the former port.

"The cost of a narrow raised road * * and of erecting two bridges, made the total cost of purchase of material and laying the line £15,683.

"On repairs to road-way a sum of £122 was expended."

"87. The original cost of an elephant in the Andamans, with freight and other charges, should be taken at Rs 1,000. * *

If, as was done last year, it is taken that it is required to replace an elephant after every 10 years, the capital involved (allowing interest at 5 per cent.) to purchase an elephant costing Rs4,000—

	Rs
Would be	10,560
(Giving a yearly cost of)	528
To this has to be added the above sum of	490
Cutting dragging paths	72
Gratuities to attendants	12
Share of elephant doctor, etc.	27
Chains, gear, etc.	30
Total cost, yearly, of maintaining an elephant	<u>1,159</u>

“ 88. The three miles of tramway line therefore saved the cost of 28 elephants at Rs1,159 each or Rs32,152. From this has to be deducted the cost of loading, etc., as follows :—

	Rs
The cost of loading 14 logs daily and of unloading for the year	2,088
Up-keep of the line	1,000
Depreciation at 10 per cent. on cost of rail material on Rs26,760	2,676
TOTAL	<u>5,764</u>
Leaving a profit of	<u>26,688</u>

“ 89. From these figures it is plainly shown that the tramways are a paying concern, and it may be added that without them it would be impossible to work these forests: and again, if more elephants were available, a larger amount of timber would be railed over these tramways, which would mean their shewing a still larger profit.”

Working expenses.—In the chapter on motive power, it has been said that a laden timber truck (whatever the load) requires four men to work it, and that one buffalo can drag two laden trucks, but in the latter case the buffalo must have a driver, and each truck a brakesman.

On these data and the rates for labour, or the cost of buying and keeping draught animals, the expenditure on the railing out of timber by tramway can be calculated in detail for any particular locality.

In the Andamans for instance, the hire of a convict labourer is (1 annas) four annas a day, of a free man (5 annas) five annas a day, and the task of every four trucking men is to rail one laden truck over an average distance of six miles and to bring the truck back to depôt in the day. The calculation of the cost of railing timber from any given point to the water is therefore a simple one. Similarly for trucks drawn by animals.

Maintenance.—Although subjected to a comparatively large amount of traffic, in wet and dry seasons alike, the Andamans tramways have never cost more than about R300 a mile in the year for maintenance. Deterioration of the line after six years is not appreciable, but there is some wear of rolling-stock and loss of bolts and fish-plates; for renewal of which an expenditure equal to 10 per cent. per annum of the original value of the stock must be allowed.

22. Viewing the introduction of tramways practically, it cannot but be seen that their use results in a great saving of time and of labour, the latter being a most important consideration in the Penal Settlement, or anywhere where labour is scarce.

It will also be admitted that the laying of narrow gauge lines is far quicker and less costly than the making of cart-roads, while the trucks used on tramways carry greater weight, and wear very much less than carts.

The latter perhaps have this advantage, that they can be taken to a log whether it lies on a road or off it, whereas a truck has to remain on the line, and wait for its load to be brought to it. But where large numbers of logs are extracted regularly means are very easily devised for bringing the timber to platforms along the line.

Cart transport can pay only where small quantities of timber are to be brought from scattered fellings.

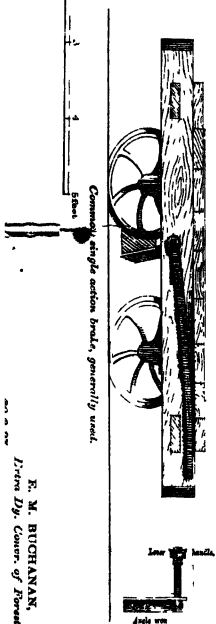
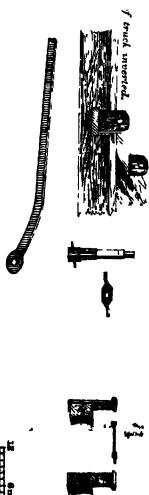
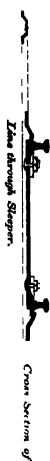
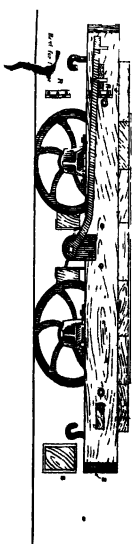
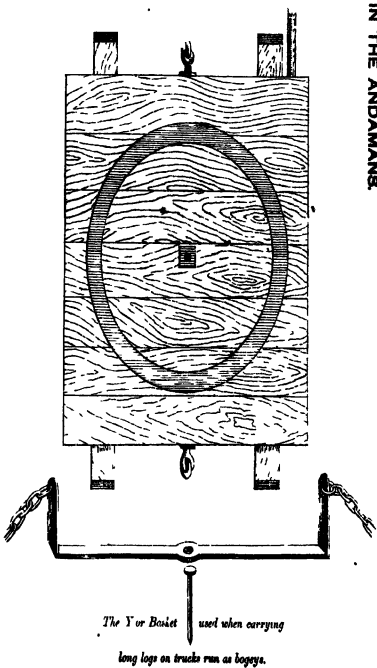
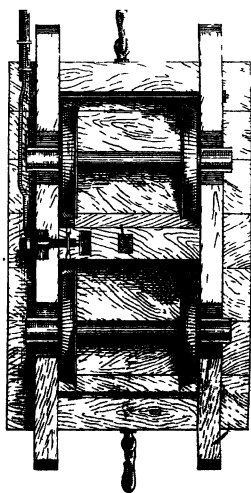
Again, as regards the cost of maintenance, the expenses of keeping a tramway in repair are so light, that in this respect cart-roads cannot compare at all favourably with tramways.

23. In concluding the notes on tramways in the Andamans, it is necessary to record that much of the information in the Notes, particularly in the paragraphs relating to gradients and curves, was gathered by Mr. C. G. Dingwall Fordyce, Deputy Conservator of Forests, when he was in charge of this Division, and his observations have in the main been adhered to after being arranged in proper sequence and slightly elaborated for the sake of greater clearness.

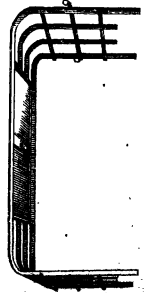
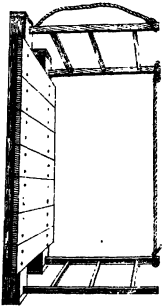
GOPLAKABANG :
The 10th May 1897.

} E. M. BUCHANAN,
Extra-Deputy Conservator of Forests,

PLANS AND ELEVATIONS OF TIMBER TRUCKS, SHOWING THE BRAKES IN USE ON PORTABLE TRAMWAYS IN THE ANDAMANG.



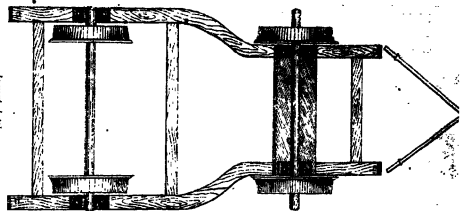
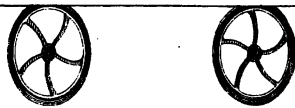
1, 2, & 3. Showing make and method of using double action brake, designed by Mr. C. G. Dargatzis.



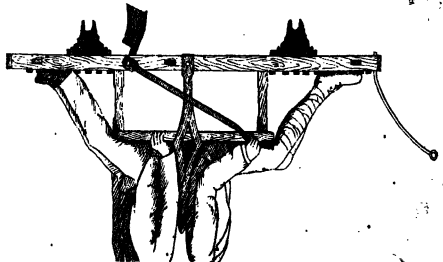
1, 2, & 3.

Trucks with crates or removable frames, which could be used for carrying firewood, canvas, or other minor produce.

Light detachable London Trolley, with 20 feet radius, giving enough play for a curve with 50 feet radius.



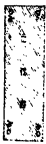
Fourth & Fifth.



as illustrated in above picture the upper plates of the trolley.



Bottom. A. B. These plates are fixed with the plates on their inner ends.



Upper plates fixed to the frame of the trolley.



Lower plates fixed to the frame in which the axle turns.

NOTES
ON
SÁL FORESTS:
THEIR
LIFE-HISTORY AND TREATMENT.

BY
S. EARDLEY-WILMOT.



CALCUTTA:
OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.
1898.

NOTES

ON

SÁL FORESTS:

THEIR LIFE-HISTORY AND TREATMENT.

On natural forests.—A natural sál forest is in these days probably impossible to find—that is, a forest in which nature alone, to the exclusion of man and all his works, has influenced the habits and life of the vegetation; but some few Indian foresters of long service have enjoyed the advantage of inspecting such limited areas, long since opened out by expensive communications, but at that time inaccessible on account of the configuration of the ground and self-protected from fires by the cool aspect and the never failing moisture retained by the luxuriant undergrowth.

In the natural forest financial considerations are in abeyance; we gaze with admiration on an accumulation of capital stored up both in the standing crop and in the soil. We promptly set to work to reduce that capital to such working dimensions as will ensure in perpetuity the highest rate of interest, and when we have succeeded in this aim we consider that we have created a normal forest. Such work is easy and satisfactory; revenue flows in and abundant reproduction soothes our feelings—tender from the necessity of

removing forest patriarchs whose equals, we know, that demon called "commercial maturity" will prevent our again beholding.

On ruined forests.—It is, however, a different matter when we have to transform a ruined into a normal forest. Our predecessors in charge have probably for centuries been engaged in removing all valuable stems, in tapping the advance growth for resin, in grazing down the covering of the soil, and, lastly, in firing the residue at the time when the parent trees possess the least vitality. Hampered by the inexorable rule that no silvicultural operations of magnitude shall proceed unless remunerative, the Indian forester is often at his wits' end to attain his object, and if not prevented, may at least be seriously delayed in the completion of what must in any case prove a lengthy task.

On normal forests.—Let us assume that a normal forest is one where, whatever the product we desire to utilise, the management is so regulated that we are obtaining and will constantly continue to obtain the highest possible annual yield consistent with the maintenance of the forest stock at its highest state of vigour and efficiency. To create a normal forest we must understand the workings of nature and be in a position to assist or to minimise the influences, beneficial or the reverse, which advance or retard the attainment of our ideal.

On artificial reproduction.—The main products of a sal forest are timber and fuel, and we trust for the maintenance of our capital to natural reproduction from seed or from coppice shoots in the one case or in the other. Artificial reproduction has been attempted, but,

so far as the writer is aware, the success obtained was insignificant, and the endeavour has been abandoned. Sál plantations in the open suffer from frost, and when this evil was combated by winter irrigation, other agencies, not understood at that time, still remained to prevent the continuous healthy growth of the plant. The artificial reproduction of sál in mixed forests also has not been successful on any large scale, and the cost and difficulty in transporting the seed has proved prohibitive.

On natural reproduction from seed.—The sál seeds ^{The blossom and seed} profusely and generally every third ^{fall.} year; to a lesser extent and more locally in the two preceding seasons. In individuals the first seed year is dependent more on age than on size. The forester will, when surveying his charge, rejoice on observing that only the stems of the higher girth classes are in flower; he will deduce the assurance that he has no stems of great age and inferior size, and no coppice poles to bring forth infertile seed from the borrowed vitality of the parent stool. There are in nature few changes more picturesque than those which pass over the sál forest in March and April; the sombre green of the old foliage turns gradually to orange and brown; then comes an interval of almost wintry bareness, followed by the assumption of the wedding garment, when each tree is a rounded mass of white or creamy bloom. It is a period of brief paradise for insect life, till the falling petals whiten the thick carpeting of withered leaves, and the tender spring foliage appears to charm the eye and to lower the fierce heat in consequence of the renewed transpiration of moisture that

has for some weeks been withheld. At this time the theory of the survival of the fittest is prominently brought to notice, and the aged and infirm, the injured and suppressed, cease from their troubles, with, as is frequently the case in the vegetable kingdom, a final effort to continue the species.

The ripening seed is sufficient for all—from man, who in times of scarcity prepares therefrom a bitter flour and dies of indigestion, to the birds, which extract the kernel and enjoy it. And when the forester has been so fortunate as to protect his charge from fire till the moist winds commence to blow, he will see the winged seed, already germinating, flocking in the air and finding its spiral course to the damp earth. In a few days every available spot will be covered with the two-leaved seedlings; and the novice, exhilarated by a fall in temperature and pleased with the success of his efforts in protection, leaves his charge to the soothing influence of the monsoon current, expecting to find on his return every blank filled with promising reproduction. The depression inevitable on the return to solitary field work a few months later is alleviated by the anticipated improvement in the appearance of the forest, but, astonishing as it may seem, there is no change of importance. A few patches of yellow-leaved seedlings still show here and there in open spaces, and in thick grass a few specimens of more healthy hue may be found; but the conviction gains strength that the result of most, if not all, of the marked phenomena of forest life in the past spring and summer is practically nothing. Such is, however, far from being the case.

The sál requires a porous soil with no excess of sand, well drained and with permanent moisture at no great depth.

The seedling.

In the hills it flourishes on rocky slopes with shady aspects, where pockets of vegetable mould supply nourishment and the stored up moisture flows gently and imperceptibly from under the luxuriant undergrowth. In the plains the height of the tree is in direct proportion to the depth of the spring level; and in water-logged localities the sál shows on its crown the inconveniences which are being suffered at its roots.

Light and moisture are sufficient to ensure the germination of the seed; the continuance of the seedling, however, must invariably be dependent on its surroundings of soil, of the quality of light and of continued moisture. These surroundings must be considered in detail.

First as regards soil; some vegetable mould is indispensable to allow of the formation and progress of the tender root system; through a hardened loam or stiff clay the rootlets cannot penetrate, and in a sandy bed the seedling suffers from extremes of temperature and want of sustenance. There are thus areas in all our sál forests where reproduction is either wholly wanting or at the most scanty, and where the standing crop testifies in its diseased and abnormal condition to the unsuitability of its surroundings in the past, aggravated perhaps in the present by decades of unreasonable treatment, or perhaps even by a more recent change in the depth of the spring level.

The soil required by the seedling.

But even if the soil be congenial to the growth of the young plant, we have still to consider the question of light. The light required by the seedling. The sál seedling requires direct and will not be satisfied with diffused light; it prefers moreover to be sheltered from the continuous vertical rays of the sun and the consequent excessive insolation and evaporation. A fair proportion of side light during the sunny hours of the day and the consequent free circulation of air, are both conducive to a healthy growth of the root system, which is at this period of most vital importance to the young plant.

And lastly with regard to continued moisture, there can be no upward growth until the tap roots are established in a permanent water-supply. The moisture required. An intermittent source of moisture would on the face of it not meet the requirements of a tree which produces its heavy foliage at the commencement of the dry season, and has to keep that foliage in order for at least two months without aid from aerial moisture.

Let us now suppose the seedling to be located in circumstances suitable to its continuance. The growth of the seedling. During the next few seasons the plant will efface itself so far as an upward growth is concerned, the sole symptom of life being evidenced by the yearly flush and fall of a few long persistent leaves. Underground, however, the struggle for existence is continued, and every effort is being made to reach with fibrous roots the permanent water-supply. This may be at a few, up to even 50 or more feet from the surface, but the protraction of the struggle

will, if it ends in success, be made good by the fact that the quality of the tree of the future will assuredly be dependent on the extent and vigour of the root system.

The time arrives at last when the plant is independent to a most important degree of extraneous moisture, and is able to devote attention to the progress of the above-ground organism; but once again has the question of light to be considered before its future is assured. It may be that the canopy has closed during the period of the underground struggle, or merely that light, sufficient for the seedling, is far in deficit of the requirements of the vigorous sapling; and in this case a period of patience re-commences when the plant, eagerly watching every opportunity of upward growth, may be constantly retarded by untoward circumstances. It is thus, when we have the advantage of frequent annual inspections of the same localities, we are often astonished to notice a sudden and almost phenomenal reproduction of sal over an area hitherto uncovered, due either to the tardy triumph of the young growth over its underground difficulties, or to the removal, by the obliteration of mature stems, of some overhead obstruction.

Such is the struggle which the individual passes through even in a protected forest, and this indicates the only manner of affording assistance—in the underground struggle, by preventing artificial injuries to the young plant; in the other case, by affording by judicious fellings the aid required to accelerate an upward growth. The physical obstructions already alluded to as hindering reproduction are, however, beyond our skill to remove, and alleviation can only come by

waiting ; the forester can only prevent their enhancement by ensuring that the soil is protected as far as possible from the excesses of climatic influences, and that high cover of any kind is encouraged, knowing that so soon as the surroundings are suitable the sál will establish itself to the extinction of other species.

We have now traced the life of the seedling from germination till the time when it stands a vigorous sapling amidst a group of its fellows, not necessarily of the same age, but of the same year of escape from the difficulties of infancy. We have noticed its period of probation and the promptness with which the death of the parent stem has been followed by the appearance of a numerous offspring, eager to fill up the gap in the forest. We must now leave the young trees to the competition that is inevitable in nature—to the accidents which must occur in a long life. Only a short time will elapse before the level clump of saplings will break up and a few prominent stems take the lead, dooming their less fortunate fellows to a further period of inactivity and proving the futility of discussing the question of age-classes in a forest where antiquity is no criterion of size, and where the root system supporting a switch may be capable of carrying a 40' pole.

On reproduction from coppice shoots and root-suckers.—The subject of reproduction from coppice shoots is neither so picturesque nor so interesting. The soil being presumably more or less suitable to the growth of sál and the root system being established, light alone is required to induce reproduction ; and were it not for the desire to protect from all danger of

frost and the necessity to replace from time to time the ancient stock, the outturn of coppice fellings would be highest if no standards were retained. These are both subjects for further investigation. It is certain that the very lightest overhead cover, throwing a most irregular and insignificant shade, is still sufficient to ward off frost-bite; yet it has also been remarked that, apart from the question of sheltering canopy, heavy frosts do not affect the young growth in some localities, whilst in others in seemingly similar circumstances this suffers severely. The connection between soil and frost-bite is certain, and it will probably be found that young growth on good vegetable mould does not suffer to the same extent as that on sandy soil, where indeed natural coppice forests are often a feature of the landscape.

It is difficult to write with certainty of the life history of a coppice shoot. The writer is personally convinced that the laborious smoothing of the stool is in no wise remunerative; he prefers to see the young shoots appear, not on the wounded stump, but lower down at junction of root and bole, believing that it is of advantage that the new growth should, as soon as possible, sever its connection with the stool, and also that the shoots which adhere to it readily become unsound. In tracing the root system of a sál coppice stool we will frequently find that root-suckers appear at long distances from the parent tree, and become practically independent so soon as they have established their own system of tap roots. There can be no doubt that those shoots which spring direct from the stool must

inherit the parental attributes ; they are parts of mature trees and possess the characteristics of maturity. Thus, as the life of the original tree is not prolonged by coppicing, it is evident that unless we are convinced that the root-suckers at a distance possess the vigour of seedling trees, we must provide standards as seed bearers to continue the stock. It will moreover be found to be a general rule that seed formed from coppice shoots is infertile, and we are thus placed face to face with the difficulty of deciding whether or not the standards we spare are seedling trees.

On the origin of coppice forests.—Those *sál* forests which we treat as coppice are as a rule incapable of producing timber of large size—that is to say, an insufficient depth of soil or other circumstances exist to prevent the growth of large trees. But the transformation of the original seedling forest may be due to nature or to the indirect as well as to the direct action of man ; frosts and forest-fires as well as the axe can bring about this change by thickening the root stock of the advance growth, and so inducing an abnormal crop of young shoots therefrom, inconveniently crowded and probably diseased or injured from the first. And the typical position of coppice forests on the outskirts of the high forest, at the tail of the alluvial deposits which on the rich depth of their upper portion support the more valuable *sál* areas, point to surroundings originally more or less unfavourable. They are valuable properties, but their rotation is mechanical ; the dense masses of undergrowth, with the regularity of the standards, become as oppressive as the monotony of the management. We return therefore with renewed interest to a consideration

of how we can create a normal forest from the means at our disposal.

On general principles of management.—It is not for us to discuss the various systems by which it may be proposed to restore or to regenerate, or to criticise the suitability of these terms: our work will be to improve and to maintain; our preliminary labour to discount as far as possible the ill-treatment of our predecessors and subsequently to follow nature and to assist her. It is also immaterial how we designate the preparatory treatment; it will probably consist in the removal of trees, both mature and immature, sound and the reverse, in order to permit of reproduction, and in combining such fellings with thinnings and cleanings to aid the advance growth; but the urgency of protection must first be attended to.

On protection.—The results of grazing, if not excessive, are indeed in some instances rather beneficial than the reverse in an abnormal sál forest, where the heavy matted grass renders it impossible for the germinating seed to reach the soil; but in India we cannot regulate the closure of a forest with that nicety in this case indispensable; and it is wiser to wait until a few years of successful fire-protection have stifled the rank growth of grass, than to risk the acceptance by the uninitiated of the inference that if cattle do no harm at one period they are harmless at all times. As a general rule grazing of whatever intensity is harmful in a sál forest, and excessive grazing, even putting out of the question its inevitable accompaniment of fire, is prohibitive to reproduction.

In the best regulated forest fires must indeed occur, and it is after the first few years of successful protection that their effects are most disastrous. The *sál* suffers probably more than any of the species found in mixture with it; the facts that fires take place most commonly at the flower and seed times and during the flush of new foliage, when also the ground is covered with withered leaves, and that the resinous bark is readily inflammable, all tend to emphasise the injury to which the species is liable. But doubtless the most disastrous effect is in the deterioration and destruction of seedlings not yet fully established. Although these may be repeatedly burnt down to the ground, extinction does not invariably follow, but an abnormal thickening of the root system takes place, whence various shoots proceed, tending not only to unhealthy crowding, but also to life-long unsoundness referable to the results of external injuries from fire.

On the typical irregularity of a sál forest.—We must assume that our operations for the improvement and protection of the forest are complete before we can proceed to assist nature by a regularly recurring treatment, premising always that such assistance would be unnecessary did we not wish to utilise the yield of the forest to the utmost, and so become forced to hasten the leisurely sequence of events as they proceed in a natural forest. The life history of the seedling has shown that in a *sál* forest regularly diffused shade of greater or lesser intensity is not what is required, but rather sudden interruptions of the canopy over small areas, causing the age-classes to be represented by groups of trees and not

by individuals dispersed throughout the forest. We may also justly infer that the rule so often quoted, that no fellings should proceed in areas where reproduction is not present, is fallacious; for in the majority of cases reproduction will not appear until judicious fellings have created the conditions already designated as essential to seedling growth.

On the treatment of sál high forest.—Supposing that the forest is, after protection is assured and after we have by our preliminary treatment removed the most glaring obstructions to improvement, stocked with a sufficiency of stems, mature and becoming so within a suitable period, we can then, but only in those localities where reproduction is at that time possible, enter with confidence on operations with a view to the collection of our yearly income and to the replenishing of our stock. Such operations may be designated by any of the terms available. We may call them regeneration fellings after one of the results following thereon, jardinage if we wish to be artistic, or if simple-minded we shall probably be satisfied with the term selection fellings, self-explanatory and therefore final. Restricting therefore our main fellings to the selection of stems commercially mature, whose removal will permit of the establishment of reproduction, our minor operations, regulated by the funds or the staff at our disposal, will be directed towards assisting in the struggle for supremacy amongst the advance growth of sál and in the treatment of the miscellaneous species which are found in mixture therewith.

The main operations call for no further remark; the subsidiary treatment, however, requires further investigation.

The subsidiary operations.

Indian sylviculture is unfortunately hampered by financial considerations. It is not permitted to us to point to a distant future for a return on present expenditure; our results must be more or less at once apparent, and hence the necessity of devoting our chief, often our only, attention to the treatment of marketable products, and of frequently abandoning our *sál* saplings and poles to their own devices, although we know that judicious thinnings would hasten the arrival at maturity. In the same way the desirable treatment of miscellaneous species may be hampered. Their presence in a *sál* forest may or may not be beneficial, for their utility depends on the nature of the soil and on the progress of regeneration in the principal species. The *Asaina*, for instance, is valuable in that it is capable of occupying localities often too damp for the *sál* seedling to maintain a healthy habit; the fact that the seedfall takes place before the annual fires has in many instances relegated this species to clayey and water-logged localities, where alone the fallen seed has escaped destruction. Other miscellaneous species have their use in providing cover where the conditions are not at that time favourable to *sál* reproduction, but as soon as that is assured they must, if they continue to exist, assume a habit similar to that of the dominant species, and often so opposed to their own that they ultimately give way under the unnatural conditions. Any excess of miscellaneous species in a *sál* forest points to abnormal conditions obtaining in that forest. If the *sál* is in the ascendant, the extinction of the less valuable trees can be aided by the forester, but if not, these must be most jealously retained. Especially will it be noted that the improvement or deteriora-

tion in the quality of the forest is marked by the disappearance or the reverse of shrubs and thorns. The latter appear to be the last effort of nature in protecting the soil from the ravages of man and beast, and in providing shelter for the germination of a higher order of vegetation.

On the results of excessive fellings.—The tendency of the Indian forester, encouraged by local financial conditions, is naturally towards the culture of forests of such density as to prohibit the growth of grass and thus become self-protective from fire. It is comparatively easy to carry out this policy over considerable areas by excessive removal of stems approaching maturity, but the results in a sál forest are somewhat disastrous. In areas so maltreated all reproduction from seed is at a standstill, and we prevent that distribution and grouping of the girth-classes which, imitating nature, we desire to arrange for. The vast majority of the crop is suppressed, and we can only afford relief by cutting blanks of limited area throughout the forest, and so permit of natural reproduction. We may be pestered in these operations by luxuriant coppice growth, most difficult to prevent when removing immature sál, and we may be forced to resort to pollarding, a system advantageous when dealing with miscellaneous species, but in a sál forest a betrayal of former errors in treatment.

Summary.—The generalities collected in these notes may be summarized as follows:—

- (1) The germination of sál seed will take place in all circumstances, but the continuance of the seedling is dependent on fixed conditions

of soil and moisture, and its growth on fixed conditions of light.

- (2) The forester can aid in the gradual introduction of the necessary conditions of soil and moisture, and he can at once artificially introduce the necessary conditions of light.
- (3) No further opening of the canopy should be allowed in localities where the conditions of soil and moisture are not satisfactory, but wherever these are favourable, the removal of mature stems and perhaps the thinning of the crop are indicated.
- (4) Treatment based on averages for the whole area of a sil forest cannot be satisfactory unless the whole area is uniform. Working-plans should therefore clearly define those portions of each compartment in which fellings are justifiable, and for those portions alone need enumeration surveys proceed or stock-maps be prepared to aid in compiling the financial forecast of the working; for the remaining areas such statistics would be useful solely for the purpose of future comparison.

S. EARDLEY-WILMOT.

12th May 1898.

NOTES
ON THE
SHISHAM AND KHAIR
IN THE
SUB-HIMALAYAN TRACTS
OF THE
N.-W. P. AND OUDH:
THEIR
LIFE-HISTORY AND TREATMENT.

BY
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CALCUTTA :
OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.
1898.

NOTES
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The Sub-Himalayan tracts of the Indian Empire are the play-grounds of its mighty rivers. Here the waters in their fantastic and ever varying course change the face of nature at their will ; a stranded tree trunk from the higher hills, a wedged-in boulder, may be made the excuse to alter the direction of a river and to wipe out a forest or a patch of cultivation fairly established with good hope of continuance. The flow of the waters is three-fold : in the winter they pass serenely with inviting ripple over a bed of gravel, or pour with whitened foam between restraining rocks ; in the spring they gather volume from the melting snows and fill their banks with a grey-green current, carrying various stray exotics to remind the dweller in the plains of the delights of the Upper Himalaya ; in the summer and autumn they throw off all restraint and inundate the country with the turbid floods of the monsoon. These

phenomena affect mankind locally in no marked way; inhabitants are few; we note what has been when it is passed, when in our drift operations we secure a log of deodar or silver fir, when some bewildered beast not indigenous to our plains' forests appears, or when we find articles of domestic use in more temperate climates stranded on our heated river banks.

In these tracts is the natural home of the shisham and khair, and from thence these species continually seek to extend their domain by committing their seed to the floods in the hope of discovering localities congenial to reproduction.

I.—The Shisham.

Abundant moisture is a necessity for the shisham, but that moisture must be in motion. On a water-logged soil there can be no favourable growth, nor will natural reproduction establish itself save on recent alluvium. Hence we find in natural forests the parent stem standing sturdy and alone, its short trunk supporting numerous ponderous branches, its root system extending deeply and widely in banks of gravel formed perhaps 50 or 100 years ago, but raised by subsequent deposits, each representing for the tree a struggle with and a victory over the forces of inanimate nature. The tree has no doubt in the past contributed to the permanence of the soil it occupies, though it too may some day succumb to riverain action and drift away on the flood past younger forests—its own progeny.

On a smaller scale, far from the main water-courses, we find similar circumstances inducing a repetition of

On the conditions necessary to the growth of the Shisham.

the same phenomena. Even in the almost waterless areas of the Sub-Himalayan tracts, and much more frequently in the more favoured localities at higher elevations, we discover narrow "nalas" where single specimens of shisham are perched on the steep banks, or little islands are covered with young growth. Following these minature rivers to the south, we trace the progress of reproduction until in the open plains we find it arrested by the saturation of the surface soil or other uncongenial surroundings.

The advance growth of the shisham becomes leafless for a short time in February.

On the leaf flush and blossom.

The mature tree in these latitudes is practically evergreen, and produces its first flush of foliage with the arrival of the first genial warmth of spring. The blossom follows almost immediately, filling the air with the most exquisite fragrance of the Indian forest, whilst the tender green of the young leaves, accentuated by the crimson flowers of the cotton tree and the flaming blossom of the "dhak," is one of those natural beauties of landscape, in themselves some recompense for the solitude of the jungles. The clusters of semi-translucent seed-pods ripen slowly and remain long persistent; a large proportion withstand the monsoon gales of the year, and are found on the parent stem in the following spring and even later.

Our knowledge of the germination of the seed and of the behaviour of the seedling

On the seedling.

is much assisted by careful observation and experiment in Oudh and elsewhere. We know that the water-borne seed when stranded by a

subsiding flood germinates so thickly as to cover the ground it occupies; and we know that the continuance of such seedlings is emphatically dependent on the successful development of the tap root, which often in an otherwise insignificant plant attains a length of six feet in the first year of existence. The great importance of this tap root must be fully recognized; any injury thereto affects the vitality of the seedling, so much so that success in transplanting shisham has, in Oudh, only been attained when the seedling was raised in six feet cylindrical tiles and transplanted in holes of the same depth with uninjured roots. The insistence on the growth of the tap root is indeed so marked that plants raised in seed beds of impermeable masonry were found to have developed the tap root to the normal length and, finding no outlet, to have formed a twisted matted root growth, rendering separation of the plants impossible. The seedling in the natural forest should find, however, no difficulty in this respect: its chief fear is that it may be wiped out of existence by a flood higher than that which deposited it; and in this way nature's efforts in the formation of a shisham forest are often repeatedly abortive. It is the abnormal flood level which is responsible for ultimate success in reproduction; and hence, as we stand on the low lands gazing towards the hills, we often observe the shisham represented by patches of advance growth in terraces, showing clearly the age-classes as represented by periodic successive withdrawals of the main stream from one side to the other of its widened course. Above all, inaccessible save in the most formidable deluges, stand the mature trees, dotted on the landscape singly

or in clumps, in strange contrast to the crowded habit of the advance growth.

The seedling having established itself on the low alluvial land, speedily attains sapling size and is thus enabled to withstand any temporary overflow, and by the density of its growth, perhaps by sacrificing a portion of the crop, to build up a barrier sufficient to break the force of or even to divert a threatening flood. Prolonged immersion the young growth cannot tolerate, but a temporary overflow, followed by a deposit of débris and loam, by raising the ground-level aids the shisham in resisting future encroachments, whilst providing nutriment for the growing stock.

The saplings soon thin out and a pole forest is formed with that tendency to an open canopy which, later on, is so marked a feature of the mature crop. The suppressed saplings may be replaced by miscellaneous growth of the numerous species whose seeds, water-borne in the various floods, have remained quiescent until opportunities for germination occurred; or, following on the admission of light, a dense growth of grass may spring up when grazing and annual conflagrations assist in the thinning out of the main crop and in the complete isolation of such stems as have withstood the constant injuries inflicted on them. Where the crowded condition of the advance growth is maintained by artifice or accident, the shisham forest increases in height at the expense of bulk, and then, while less able to withstand influences adverse to its existence, is also rendered less valuable for some of the purposes for which its timber is specially prized.

Summary of the life-history of Shisham. The life-history of the shisham in a wild state is therefore simple. The fortuitous deposits of water-borne seed above ordinary flood level; the power of resistance in serried ranks of the advance of future floods; the natural thinning out of the crop and the maturity of the isolated stem above the reach of floods save of phenomenal height and fury.

On artificial reproduction. The artificial reproduction of shisham requires perfect drainage, a percolating soil and a constant supply of moisture. Given these conditions, the growth of the tree from seedling to maturity proceeds with the utmost regularity and celerity. Stems of six feet girth and over, their age from 25 years and upwards, may be seen on the banks of canals hundreds of miles from the natural habitat of the shisham, standing on the excavated soil of the artificial water-courses. But the timber as compared with the natural grown shisham is poor in quality, it lacks colour, hardness and density, the typical lime deposits in the fibre are wanting or infrequent. Where, as in Oudh, a constant and perceptible flow of water is not everywhere available, the shisham in plantation has been an almost unmitigated failure. The expense of transplanting in cylinders as before mentioned is prohibitory, the difficulty of protecting direct sowing is immense, and the localities chosen, mainly on account of the presence of perennial moisture, were in many cases unsuitable; drainage being insufficient, the roots became water-logged and no upward growth was possible. In other parts of the country, however, where the alluvium is deep and composed of

light soil and where a moving body of water exists at a suitable distance from the surface, considerable success has been obtained, both by sowing *in situ* and planting without artificial irrigation. The reader need only be referred to the *sailaba* plantations in the Punjab as the most striking example. The difference of a few feet in depth of soil is nowhere so apparent as in the growth of this species; a tree will flourish on an embankment raised a few feet above its companions, who languish at its foot; whilst in some localities the artificial forest shows, as it dwindles from a fair average height to a stunted growth, that the forester has attempted to force nature to accede to his whim in creating a plantation in an unsuitable locality.

Of reproduction from coppice shoots and root-suckers not much need be said. The first and most important utilization of shisham must be in timber. It yields indeed a good fuel, but where the "babul" can be grown the latter is preferable, both as regards heating properties and also in reference to the subsidiary products in bark and gum; so that only in peculiar circumstances would the coppicing powers of the tree and its vigour in producing root-suckers be called into requisition.

The habits of growth of the natural shisham makes it specially valuable for the purposes it is used, namely, in the Ordnance Department, for carriage building, furniture and cabinet-making. The thickness of the trunk yields large blocks of timber and broad planks; the massive branches afford on natural curves many articles demanding special strength. All these advantages disappear with artificial cultivation and herein

On the utilization of the
timber.

is indicated the mode of treatment we should adopt in a natural shisham forest.

As has been implied in the foregoing paragraphs, the tendency of the shisham is to form forests of limited area of strictly one age-class. The various age-classes may accidentally be accurately represented by blocks of forest in close proximity to each other, designating an accidental regularity in the alluvial deposits of a river or water-course. But as a rule this regularity seldom occurs in nature, and our management must deal with separate areas each carrying a crop of one age. This treatment must perforce be simple, because, beyond the preservation of seed-bearers in suitable localities — that is, within reach of flood waters—we cannot assist in natural reproduction. We cannot moreover in the majority of cases provide for the continuance of a seedling forest in one locality; we can only assist in its formation in other suitable places; for, as before insisted on, natural reproduction from seed occurs only in certain conditions, and these conditions are not frequently present in a mature forest. Protection from cattle and from fire must always be taken as an acknowledged necessity in an Indian forest, and the shisham is especially liable in its youth to injury from browsers, and later on, when the forest is open to damage, especially in the side branches, from fire. Thus when our stems are mature we will do well to remove them at once, always endeavouring to fix the age of commercial maturity so high not only that we shall obtain special values for our timber, but also so that the miscellaneous species, which will in protected

areas generally replace the main crop, may have time to establish themselves and protect the soil from the action of water and climate, leading up in the future perhaps to an amelioration that may permit of the area being claimed and held by the adjoining sál forest. If such care is not taken, a sandy waste covered with grass will speedily replace the shisham forest of the past. Specially is to be deprecated the removal of mature stems standing on the banks of streams and rivulets. They may be tottering to their fall owing to the cutting away of the cliffs to which they cling, but the intrinsic value of the stem cannot be compared with the benefit which may by chance, however remote, be derived from one more seedfall floating away on the current below. The treatment of the advance growth consists, in the earlier stages, of protection without interference. Later on, should this policy have so favoured the crop that it tends to the development of lank and top-heavy poles, cuttings may be necessary, regulated in their severity by the urgency of the occasion. Such abnormal forests are specially liable to windfall and to uprootal by flood waters; the severe storms that pass along the wide open beds of Indian rivers are difficult to withstand, and cases have also been observed where the entire crop of swaying poles has been laid low by a flood which would not have injured a forest composed of more sturdy, though no older, units. Therefore thin, early and gradually but thoroughly, if, in protected areas, substantial and steadfast stems are required.

We must now proceed to the consideration of the companion of the shisham, though not a tithe has been

recorded in these short notes of all that is interesting in the life-history of this beautiful and valuable tree. Those fortunate foresters whose work lies in the picturesque wilds of the Sub-Himalayan tracts will no doubt, as the writer has done, find it a labour of love to observe, and to give their fellow workers the results of these observations.

II.—*The Khair.*

This tree is indigenous in the same tracts as the shisham, but it extends further east and does not thrive at so high elevations. Moreover, though in similar circumstances equally gregarious with the shisham, it is not so particular in choice of soil, nor are the conditions of natural reproduction so defined. The best and most ready growth is doubtless on new alluvium, but the species is found, though often stunted and inferior, on poor soil on the sides and tops of ridges, where the theory of water-borne seed cannot be maintained; and the conclusion must therefore be admitted that in some circumstances—favourable to the khair and often most uncongenial to other trees—reproduction takes place in the immediate vicinity of the parent stem. There can, however, be no doubt that the most vigorous and important forests spring into existence in a manner similar to that described under the shisham.

The khair possesses little beauty as a tree. It remains leafless for some weeks before the new foliage appears with the spring; the somewhat

Description and comparison with the Shisham.

On the leaf, flush, blossom and seedfull.

insignificant flower two or three months later. The seed-pods remain long persistent, thus favouring their gradual dispersion during the monsoon and winter storms.

The behaviour of the seedling is similar to that of the shisham, but the phenomenal growth of the tap root has not been remarked by the writer. In pure forests the saplings, crowded together in their rapid upward growth, soon attain their maximum height; and, as is the case in all light-demanding species, rapidly thin out. Where khair exists in forests of miscellaneous broad-leaved species, it is suppressed as soon as it is overtopped; here frequently excessive length and inferior diameter measurements proclaim a departure from the normal habit of the tree due to unusual surroundings. The larger trees maintain often in their immediate vicinity a space clear of all vegetation, a fact which may save them from suppression by more quickly growing species. On high grounds single trees of all ages may often be observed, or groups of advance growth in "nalas" and depressions.

Artificial reproduction of khair has been singularly unsuccessful in the localities to which these notes refer, though under different conditions in Burma the tree is cultivated successfully over large areas, chiefly by direct sowings in *toungyas*. Plantations raised from seed have been attempted, in the North-Western Provinces and Oudh, with sowings in pits and in ridges; but the results, despite the fact that mature khair existed in the neighbourhood, gave only bushy

On the seedling and the growth of the sapling and tree.

On artificial reproduction.

growth fairly persistent, but with no promise of timber trees. Reproduction from coppice shoots is vigorous enough, but whether this will result in the growth of marketable stems is still doubtful.

The chief utilization of the khair is for the production of catechu ; as a bye-product, charcoal may be mentioned. The commercial maturity of the tree is not yet satisfactorily fixed ; for local circumstances outside the highest production of catechu must be taken into consideration. The configuration of the ground may be such as to prohibit wheeled carriage, when only stems thin enough to be carried on men's shoulders will be utilized ; the scarcity of water may be the cause of a limitation of coupes areas ; the scattered nature of the forest may, on the other hand, compel either a great increase in the size of the coupes or a reduction of the annual outturn on account of an insufficient number of stems within working distance of the kilns ; the peculiarities of the workmen, who sometimes insist on certain conditions of colour or appearance of the wood, may prevent full utilization of the yield : such are some of the circumstances that, outside those conditions of soil and moisture influencing the rapidity of growth, must be considered before it can be determined at what age we will dispose of our standing crop. And on this determination our treatment must be based.

The khair is even more susceptible to injuries from browsing and fire than the shisham. Its lighter shade permits a ranker growth of grass, resulting in greater intensity of conflagration, whilst the tender shoots are

On the utilization and period of maturity.

On the treatment to be adopted.

more eagerly sought after by browsing cattle than those of the shisham. Protection is thus urgently necessary ; but beyond this it is doubtful if the forester can render assistance in those stages of growth before maturity is reached. The intolerance of the slightest shade is in itself an assurance that the leading shoots will not be hampered in their growth, and with a species that shows such reluctance to natural regeneration under the parent stems, it would seem wiser to maintain the forest as long as possible in one locality by not removing the suppressed stems, which may, when opportunity arrives, replace the mature stems as these latter are utilized. But where advance growth is absent, mature stems should invariably be removed, for if they have not induced reproduction or aided in the establishment of other species when the canopy is most open, there is little hope of subsequent improvement. But, as with shisham, seed-bearers standing in suitable localities must be left.

To summarize these notes :—

1. The regeneration of a shisham or khair high forest does not, as a rule, take place in nature. The species are continued by the formation of new forests in suitable localities at a distance from the parent stems. The khair presents more frequent exceptions to this rule than the shisham.
2. For this reason the retention of mature trees solely with a view to local regeneration is not necessary, though other reasons may exist to delay their removal.
3. The advance growth of both shisham and khair requires no treatment beyond protection ; protection is, however, necessary and specially in the case of the khair.

4. Pole forests of shisham artificially protected require thinnings if we wish to obtain the best timber trees. With khair the greater intolerance of shade permits us to omit such operations in the hopes of a prolonged local continuance of the forest.

20th May 1898.

S. EARDLEY-WILMOT.

NOTES

ON

IMPROVEMENT FELLINGS

IN

SAL FORESTS.

BY

S. EARDLEY-WILMOT.

NOTES ·

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IN

SAL FORESTS.

Introduction.—The term improvement fellings appears to have fallen into disrepute with some foresters who disapprove of the title and question its application, and with others who not only seem to consider the system the refuge of those destitute of originality, but also are weary of the reiteration of its prescription. To the first we can say that the name is nothing, so long as we are at one in our understanding of its meaning; to the latter we can tender the sure hope that, with the advance of successful silviculture in India, these operations may soon become legends of the past. But at the present moment we are, and have been during the past seven years' engaged in Oudh in improving 350 square miles of sâl forest, with a yearly outturn of about 10,00,000 cubic feet and a revenue of some R2,50,000; and the experience thus gained form the subject of these notes.

Before proceeding further, however, it will be necessary to define the objects which were set before us. The forests with which we had to deal were neither similar to each other nor uniform in themselves. In some, for instance, we were burdened with aged and worthless stock, cumbering

Description of the forests.

the ground and hindering regeneration ; in others the crop was approaching maturity, but the growth of the principal species was unsatisfactory or hampered by pressure from inferior trees ; in a third a young forest had to be thinned by removal of injured or ill-grown individuals. Such are examples of some amongst many of the types of forest distributed over so large an area ; in all we had to deal with such important departures from the normal that it was impossible to prescribe any regular treatment for the forest as a whole until what we may call irregular treatment, that is, operations based on purely local desiderata, had so influenced the areas worked over that it should become feasible to carry out a continuous system of working suitable to the forest in its entirety.

The reasons for the divergence from normal growth above indicated are known to all Indian foresters. The effects of continued ill-treatment by men and cattle in the past could not be at once discounted by a period even of the strictest protection. Indeed during this period the refuse stock, being in preponderance, had opportunity to assert itself to the detriment of the advance growth, whilst at the same time financial pressure had in more than one instance compelled the removal of a certain proportion of the sounder stems which should, indisputably, have been retained in the interests of the forest. The gain from the vigorous conservancy of the last 20 years must be sought in the renewal of the canopy and consequent improvement of the soil ; in affording a period of rest from the more active spoliation of the past, in the cessation of payments of yearly dividends from forest capital, rather than

Reasons for the condition of the forest.

in the actual increase in value of the harvest of the immediate future. To induce that improvement something more was necessary than passive protection, indispensable though that might be as a preparation for the more drastic measures which were to follow.

The object, then, of the operations we proposed to carry out in the many types of forest distributed over so large an area was amelioration, sometimes (when its age permitted) of the growing crop, but always (whatever the conditions) of the crop of the future; so that the term improvement fellings must, so far as these notes are concerned, be taken to mean operations as general and as comprehensive as would serve to improve the present and future state of the forests for which they were proscribed, with the view of introducing as soon as practicable a regular system of selection fellings which is deemed to be the most appropriate treatment in the future. It will be seen then in Oudh that improvement fellings are considered to include cleanings, thinnings and weedings, in short all cultural treatment of the stock which tends to improve the forest; and if exception is taken to the term it must be solely because, in the ordinary acceptance of the word fellings imply the reaping of a portion of the forest harvest, whilst operations for improvement on the other hand mean merely the removal of harmful growth which may or may not have a money value.

It has been elsewhere remarked that in a normal sal forest reproduction from seed should be in progress over the whole area at all times, that the age

The object of the operations.

The two operations necessary for improvement.

classes, or their equivalent, should be represented throughout the whole area by groups of stems, that the forest should be so constituted that the removal of mature trees here and there over the forest should inevitably be followed either by the appearance of seedlings or the assertion of the advance growth. The first aim of our improvement fellings would be therefore to favour those conditions likely to produce these effects; to encourage adequate regeneration of the principal species so that its reproduction should be everywhere amply sufficient to replace our removals after making due allowance for all accidents, both natural and artificial, which might occur before the seedlings arrive at maturity.

The next point which should engage our attention, after having to the best of our ability assured the crop of the future, would be to better the condition of the growing stock by weedings, thinnings and cleanings, removing inferior growth and freeing the vigorous and sound from overcrowding or oppression. We desire in fact now to utilize to the full the possibilities of a soil improved by years of rest, and to regulate our forest growth in that manner calculated to produce the largest quantity of the material under cultivation. Having thus classified our operations under two main heads, we can now proceed to the consideration of how they may be applied in forest where the principal portion of the crop is mature, where it is approaching maturity, and where it is immature; for it is not possible to write of the varying types of forest as a whole, and probably this classification is the simplest and most effective for the purpose; although of course many intermediate types will be noticed in practice.

When we hold ourselves responsible for the regeneration from seed of a ruined forest where the larger portion of the volume of the standing crop is mature and the girth classes are not everywhere represented in proper proportion, the task requires all the detailed care that the forester is able to afford. Theoretically, if the averages for the whole forest are satisfactory, the removal of all mature trees, which would, if spared, be in excess when later on our selection fellings take place, is indicated; but in practice this is impossible. Inspection of the area will probably disclose the fact that differences in quality of soil or other physical factors have already influenced the standing crop, and are now influencing the seedling or advance growth, so much so perhaps that in some localities regeneration for the present is impossible. Between such a state of affairs and that where the ground is densely stocked with sál stems of every age-class and where the removal of all overmature stems is imperatively demanded, an ever varying intensity of felling is required which can be dictated only by the local officer. Nor is this in mature forests his only if his most important work. In theory again, if the girth classes were proportionately represented over the whole area, removals of trees approaching maturity would be improper, in a normal forest at any rate rare; but in the ruined forests we have to treat we may perhaps find not only a partial numerical preponderance of stems of the immediately lower class, due to the too extensive removals of mature stems in the past, but also a considerable number of crooked and hollow trees long passed the age of maturity but never destined to attain the diameter fixed as the standard of

The treatment of mature forests.

utilization. The removal of stems of the two highest girth classes must therefore depend entirely on local circumstances ; where the crop is represented by individuals of all classes or where regeneration is complete and advance growth struggling for space, we may without hesitation fell the greater portion of the ripe or overmature part of the crop, for the removal of these, for the most part injured, trees will give room for the expansion of a sounder stock, but we will restrict our operations to careful selection of single stems where we find that reproduction is still uncertain, or where we notice that the next lower girth classes are inadequately represented ; and we will altogether forego our fellings where isolated trees are scattered in grassy glades, where the condition of the soil or other surroundings are for the present antagonistic to seedling growth, or where we desire that the principal species should ultimately extend over areas as yet apparently unsuitable to its growth.

In the forests under consideration although the most important steps towards regeneration from seed may have been taken by treatment of the higher girth classes, the improvement fellings are by no means completed when that portion of the crop which it is considered should be removed for the benefit of the remainder has been marked, felled or girdled. So far indeed we may have been limited or at least guided by the prescriptions of the working-plan which even in irregular treatment of forest areas endeavours to combat the idiosyncrasies of the individual by encircling him with a margin of safety. By the removal of trees of the higher girth classes we have, it is true, affected the canopy so far as high cover is concerned, we have broken the shade where

this is too dense, and have thus given opportunity to seedlings to spring up and to the older growth to advance. It is indeed only when this portion of our operations is complete that we can judge of its effect, for the forester is not yet born who in a sâl forest will in one operation satisfactorily mark all trees suitable for removal over a given area without being obliged to return over the ground to give the finishing touches to his work. For this reason those working-plans that prescribe fellings of mature overwood, together with thinnings and cleanings in the operations of one season, are, though theoretically correct in restricting the period of disturbance, yet in practice wrong in that they are setting the forester an impossible task. This matter may, however, be considered later on when treating of the conduct of the fellings; at present we are engaged in completing arrangements for regeneration and entering on those that will benefit the growing crop. These two operations indeed overlap. We may suppose that our fellings and girdlings of mature stems have been so effective that high cover no longer prohibits regeneration; that, without exposing the soil to excessive isolation, we have throughout the area arranged that groups of seedlings, saplings and poles shall have freedom for upward growth and that stems approaching maturity are neither in excess nor deficit. We should now turn our attention to the more insignificant obstructions, and as experience has happily taught us that low cover may act with disastrous effect, not in preventing germination, but in hindering the advance of the seedling, we should insist that shrubs of low or medium height should be, where necessary, removed at the same time that we are endeavouring to lessen lateral pressure by

thinning out the principal or inferior species and weeding out such miscellaneous stems as we have reason to believe will shortly be replaced by others more valuable. In these operations although permanent injury is not probable from careless treatment, yet results exactly the opposite from those desired may be thereby easily induced. The cutting of shrubby growth, the thinning out of sál or felling of miscellaneous trees may give occasion to a luxuriance of coppice shoots more harmful than were the parent stems. In subsidiary operations in improvement fellings therefore, whatever the type of forest, it is of importance that the cuttings should not be at ground level but at a considerable height above the soil, the pollard shoots from these stems will then as a rule be so feeble as to exercise little harmful effect on the seedling or advance growth.

When we desire to improve the condition of forests where the main portion of the crop is approaching maturity, we are at the outset deprived of the advantage of large monetary returns from our operations, and are often hampered by the natural desire of the official to obtain revenue and of the purchaser to compass illicit fellings, both at the expense of the forest. The theory that we may remove all mature trees which, if left standing, would, when our regular selection fellings pass over the area, be in excess is here not of much value; for the mature stems are mostly those which in the former spoliation of the forest were abandoned as worthless for timber and have since become more so; but as we shall in these forests find generally a most abnormal arrangement of the girth classes where the first is in marked deficit, the second in

The treatment of forests approaching maturity.

excess, the third and fourth in deficit, and the fifth again in great excess, our removals must naturally bear chiefly on those stems that are approaching maturity, and provided a careful discretion is exercised in the selection, such removals must in the abnormal condition of the forest tend to its present and future welfare. There is in these forests small need to provide for regeneration, save in those extremely limited areas where the soil or physical features are to some extent antagonistic to reproduction from seed; in such localities the same treatment as that recommended in mature forests is indicated; but the main point to be considered is that our removals should be so arranged that when the selection fellings of the future pass over the area we shall have thereon a suitable number of stems of the two higher girth classes, say, 3 of the first and 8 of the second per acre, whilst the space afforded by our operations should in the meantime have encouraged the trees of the third and fourth classes to take their proper place in the scheme of growth. The intensity of the fellings of trees approaching maturity should then be regulated by the local officer more with an eye on the future than with regard to the present. As a rule, which may, owing to special conditions, be held locally in abeyance, trees of the third and fourth classes should not be interfered with, whilst our subsidiary operations will comprise chiefly the thinning of *säl* in the lowest girth classes, weedings of miscellaneous trees, specially those of large size, and sometimes in the cleaning of shrubs and other smaller growth. In these forests, as has been before remarked, regeneration is generally complete, but we may frequently aid the young stock more than is the case in mature forests,

provided that we are careful to prevent an injurious after growth following on the operations.

The forests coming under the classification of immature are those where the chief portion of the stock has not yet entered the first or second class.

The treatment of immature forests.

There are two main causes creating this condition, one the actual removals of the past embracing not only timber trees but also poles suitable for temporary buildings, the other the impoverishment of the soil due to continued ill treatment prohibiting as rapid a growth as is generally the case in a well-tended forest. In these areas indeed the forester has to bear continually in mind that the object in view is the creation of a normal seedling forest in the face of the ever present tendency to degeneration to a coppice growth, and this being the case, the great importance of so regulating his operations, so that every assistance shall be afforded to regeneration, is specially indicated. The overwood in these tracts is indeed, as a rule, distorted and hollow with no length of bole (though here and there straighter and sounder stems are sparsely scattered) and is therefore valueless for future use and may, provided advance growth is present, well be removed to the benefit of the crop. But this opening out of the canopy should speedily be followed by the appearance of seedlings if we are careful to retain sufficient seed bearers (at least 3 per acre) to provide for suitable reproduction. Another effect of this thinning will be to favour the next lowest girth classes and to stimulate their representatives to take the place of the stems removed, and so form the crop of the future on which in our first felling period in selection fellings we must depend. In the subsidiary operations

little thinning of the lowest girth classes will be necessary, but where this is the case it may be restricted to stems obviously of coppice growth that may be so treated that future reproduction of shoots will be difficult. On the other hand, cleanings of low and medium shrubs will often be found advisable, as also the weeding of miscellaneous growth which in an ill-treated and ill-tended sāl forest is often in marked excess, to the crowding out of the principal species.

Before proceeding now to a consideration of the conduct of the fellings and methods of working, it will not be out of place

On Protection.

to add a few words on the protection of forests under treatment by improvement fellings. We have not in India the time or the funds to so regulate our silvicultural operations that the changes they cause shall influence the forest gradually ; we must at once complete the work without the possibility of returning on our steps for a long period, with the result that the effects may at first be too drastic and later on insufficient. To judge of the value of operations the forest should be studied some years after these are complete. But this very fact renders protection during and shortly after improvement fellings all the more important. Of cattle we need not write, for, save when forced from one area to supply timber and grazing to concessionists, no forester would of his own free will consent to any removals whatever from a forest open to cattle. It is from fire that the greatest danger may be anticipated. The opening of the canopy is often followed by a heavy growth of grass which remains until the canopy closes or until the advance growth of sāl overtops it, protecting meanwhile both the soil and the seedlings ; the disastrous effects of fire passing through these areas is such that

the forester is justified in taking every precaution at almost any cost in insuring the forests from any possible danger in this direction, and if he is not prepared to do this, he should hesitate before inaugurating such operations as may result in deterioration as easily as in improvement.

The history of the sâl forests of Oudh thus has been first spoliation without protection ;
 next vigorous conservancy dis-
 counted by inopportune selection
 fellings when, following in the footsteps of the destroyers, the best material was removed from the forests ; lastly, organized improvement fellings wherein the refuse material is utilized and the forest capital built up instead of squandered. This latter change in policy was accompanied by many difficulties, further enhanced by a change in the agency of removals, from departmental fellings and deliveries, to fellings and removals by purchasers ; and though, owing to improved communications, notably to the construction of forest feeder railways, we are now in a position to utilize small timber, such as narrow gauge sleepers and scantlings, it is yet due to the Forest Department to record that the construction of these railways did not precede but followed the compilation of working-plans, and that the estimates of removals from fixed localities over a fixed term of years, together with the valuable free grants of forest land and timber, influence to a great extent, the promoters of these railways in the selection of their alignment.

These working-plans have doubtless served their purpose both in justifying the construction of expensive communications as well as insisting on a

The past and present treatment of the forests.

Criticism of the present working-plans.

regular sequence of work in the forest ; but they are not such as we would now be satisfied with after the experience of the past few years. The main objection to them is that the prescriptions are based on averages of the total crop throughout the forest, an area too extensive and irregular to make them of much value. In future descriptions of compartment at least as much attention should be paid to the causes of variation in the crop as to the effects, the latter appeal at once to the ordinary observer, but it may be necessary to direct attention to the former. Differences of soil, of water level, etc., should be carefully noted and a map should be prepared showing the area where fellings may proceed and those where no fellings are required. If leisure and talent are at our disposal, this system might well be further extended to prescribe to a certain extent the intensity of the fellings and so not leave too much to the discretion of the local officer who may not have the experience or energy to take the initiative. Again, it should not be prescribed that the main fellings and the subsidiary operations should proceed simultaneously in any area because, as has already been remarked, it is impossible that this should be done. The two operations are distinct, and to be effective the one must follow the other. Moreover, it has been pointed out that one of the main objects of the improvement fellings is to assist and encourage regeneration over the whole sâl area, hence it should not be prescribed that no removals should take place except where reproduction is established, for often regeneration is the immediate result of the fellings. Such are some of the exceptions that may be taken to the first working-plans regulating improvement fellings Oudh.

When improvement fellings have been prescribed as the correct treatment for a forest, it is evident that the sooner they are completed the better, and it therefore follows that the size of the coupes must be regulated by the amount of produce the market can absorb. There is an intense dislike amongst foresters to govern sylviculture by finance, but the Indian forester will soon learn to repress this feeling and to realize that as is his revenue so shall his funds for improvement and protection be. The position of the coupes should be so that all are as conveniently as possible connected with the system of communications; it is obviously preferable to have all coupes equally accessible than for some to be more so than others; for merchants are easily upset at any departure from established custom which may entail the slightest inconvenience.

With regard to the agency of removal, we need only write of sales to purchasers by area and by volume; the latter system is at present thought to be most desirable as it provides more efficient check on the export. In sales by area there is the constant desire on the part of the purchaser's to obtain as much valuable material as possible from his coupe, and this requires very constant supervision to prevent fraudulent fellings. In sales by volume, on the other hand, the purchaser pays at varying rates for what he removes, and the residue is disposed of in the subsidiary operations, the following season or later on, as dry timber. Sales by area are, however, well adapted to the extraction of dry, felled or girdled timber or other easily recognizable produce of uniform quality, and have the advantage that the removals are thorough, whereas

in sales by volumes these are limited by sale prices and decrease as these rise.

The markings of timber trees must be completed in the season before felling in order to give an opportunity for revision of the work and to enable purchasers to inspect the area. In working-plans which limit the number of sound and unsound stems for removal, a check is placed on the marking operations, yet this is not so real as would appear, for the difference between sound and unsound standing trees is difficult to detect, and the staff have always the excuse of ignorance even if they intentionally deviate from their instructions. That a staff without technical knowledge and guided only by a few of the simplest rules should be expected to carry out the markings scientifically is manifestly hopeless, and it is probable that a system of mechanical markings in improvement fellings would, in the present state of the subordinate staff, yield equal, if not superior, results. If the working-plan officer could with any approach to accuracy prescribe the removals per acre from given areas of varying quality, it is more than likely that better results would be obtained than by, as at present, prescribing the total number of stems that may be felled over vast areas in which all types of soil and growth are represented. Where, however, the number of stems to be felled is not prescribed, the markings are still more in the hands of the subordinate staff, and it remains for the Forest Officer to divide his coupe areas roughly into suitable blocks and himself fix a numerical limit per acre varying, but over considerable areas, with the quality of the soil and constitution of the forest. Too little attention has been paid to the fact that the register of markings will show at a glance whether or not the proposed removals are in any girth class disproportionate

to what we know, either through the description of compartments or from our own knowledge, to be fair averages of that portion of the standing crop. The record of markings by species and girth classes will moreover enable the Forest Officer to accept tenders up to the maximum yield of the coupe, whilst the register of daily fellings and of outturn from serially numbered stems will provide the detail requisite to a knowledge of how the work is proceeding, as well as for the compilation of the control forms.

From these returns, too, information as to the number of unsaleable trees left standing in the coupe to be felled or girdled in the subsidiary operations will be forthcoming. These operations cannot be prescribed or checked save in a most general way; we can lay down rules for the guidance of the subordinate staff, but the extent of their application must depend on the possession of intelligence and energy. The operations will, too, be difficult to check as they proceed, for although the cutting of shrubby growth and thinnings of stems of the lowest girth classes is completed as the gangs pass through the coupe, yet the cleanings and weedings of miscellaneous trees being usually accomplished by girdling, we shall have no opportunity of judging of the effects produced until the foliage has withered; and as in the majority of cases, the girdling of unsaleable mature trees will also proceed in the subsidiary operations, the difficulty becomes very real. As before remarked, the full effects of the improvement fellings cannot be correctly estimated until they are complete. As a rule the danger has to be guarded against that the remunerative fellings of timber trees are not too heavy and the unremunerative after operations too light. If the

arrangements for fire-protection are adequate, we gain confidence to permit heavy thinnings and cleanings where these are required, but at the same time a greater power for evil is placed in the hands of the executive staff. Thus in those forests where the subsidiary operations are of principal importance, it is well nigh indispensable that a small sample area should be prepared under the personal supervision of the Forest Officer to remain as a pattern and reference for the work of the coupe.

In these short notes where only generalities can be considered in spite of the fact that
 Conclusion. the removal or protection of each single stem operates on the future of the forest for good or evil, it is only natural that the subject should be superficially dealt with. Its study, however, will be of absorbing interest to the forester who has the welfare of his charge at heart, and as his intimacy with the sál forest increases, he will ever discover new facts and draw new inferences tending most probably to alter his preconceived opinions. Above all let him refrain from hasty judgments and, as far as possible, prevent others from forming a premature conclusion on the result of operations incomplete or perhaps barely completed. The forces of nature work slowly when compared with the impetuosity of man, and the writer has before now heard censure passed on fellings as too intense, and seen forests hold up as awful example of what should not be when a delay of a few months would have proved that the faults in treatment, if any, were exactly the opposite of those complained of.

S. EARDLEY-WILMOT.

The 5th February 1899.

NOTES
ON THE
SÂL COPPICE FORESTS OF OUDH.

INTRODUCTION.

The coppice forests of the Oudh Circle extend over an area of about 120 square miles and are worked on a rotation of 20 years with the main object of supplying fuel of from 3 inches to 9 inches diameter to various industries. The outturn, so far as we can estimate from progress already made in the first felling period, may be reckoned at from 15 to 22·5 maunds of 2 cubic feet solid per acre per annum. A certain number of standards, varying with the girth class from 60 to 80 per acre, are retained with the object of protecting the young growth from frost or excessive insolation, and of providing seed-bearers in the hope of renewing the stock of coppice stools.

2. The forests selected for this treatment are situated in the most southerly and accessible part of the circle, for one reason that improvement in communications extends northwards from the more densely populated areas in the province, and without railway carriage the movement of fuel is impossible; and also because the more valuable timber forests of the circle are situated in the north where the alluvial sâl-bearing deposits are wide and deep; as these become narrow and shallow towards the south, timber trees cease to flourish and the

sal is represented by an inferior and stunted growth which lends itself particularly well to the treatment above indicated.

3. We have, therefore, in the Oudh Circle, a combination of circumstances permitting of remunerative operations in the coppice forests thus rendering these areas singularly valuable. To enable an idea to be formed of the sale price of fuel in favourable circumstances, it may be mentioned that in the Ramgarh forests of Gorakhpur 304 acres of coppice felled by the Department realized in 1898, R17,000, 297 acres fetching in 1894 only R2,625. It must not, however, be imagined that such prices are everywhere obtainable. To create a market and to induce contractors to embark on the fuel trade, it has before now been found advisable to permit export on a nominal royalty of R0-8 per 100 maunds, equal to 400 stacked or 200 solid cubic feet. The necessity for working these forests without delay may justify the acceptance of such low rates ; such necessity will later on be explained, these introductory paragraphs serving merely to present a general view of the circumstances of the case before proceeding to discuss in detail the silvicultural observations for which opportunity has in the last few years been afforded.

On the maintenance of Coppice Forests.

4. With such large areas under treatment and with the interests of many industries at stake, such as railways, sugar refiners and brick-burners, it is imperative that we should endeavour to discover the best method of treatment and the various factors which go to stimulate or retard a healthy and vigorous coppice growth ; and we must above all consider how the continuance of these

forests is to be assured. This latter enquiry would indeed seem to be of primary importance. We observe everywhere in nature a tendency prohibitive of a repetition for an indefinite period of a similar sequence of events ; in the vegetable world this is specially well marked and is acknowledged in agriculture by prescribing a suitable rotation in the crops won from the soil. Where long lived timber trees take the place of cereals events doubtless progress slower, but it is probable that the final results are the same, and that any pure sál forest originating even in the most favourable circumstances would, if left to itself, in course of time die out. Our best sál forests stand on soil which not many hundred years ago supported no growth of this species ; in some cases this soil was at that time arable land, in others fresh alluvial deposits, or perhaps recent debris from the hills above, and there is probably no instance of a sál forest occupying the same locality from time immemorial. Deterioration of the soil may certainly be caused, not so rapidly, but as inevitably, by the exhaustion incidental to the continued cultivation of one species as well as by maltreatment in other ways more evident to the observer. That this may be the case was brought to notice in the Bhingá sál forests of the circle where the soil, impoverished from whatever the cause might be, refused, until after a quarter of a century of repose, to permit of sál growth, although it maintained other trees, and was certainly suitable for agriculture.

5. This exhaustion of the component parts of the soil necessary for the production of the one species would probably be much more marked in the case of coppice forests where the yield is heavier and the crop attains maturity at more frequent intervals than in timber

forests ; it would result even more rapidly from the desire to prevent the formation of mixed forests, which implies a diminished output of the best fuel by permitting the growth of the less valuable species. But these considerations, interesting as they may be, can lead us to no practical results and of more immediate importance is the duration of life of a coppice stool.

We have no reason to assume that the root system of a tree acquires longevity by being at stated short intervals deprived entirely of its chief means of subsistence and by being forced to reproduce at short notice its vital organs at, it may be presumed, some strain on its vital energy. The inference indeed is that oft-repeated coppicing lessens the length of life were it not for the fact that root-suckers have often the power of detaching themselves entirely from the parent stem so soon as they arrive at vigorous growth. It may be that in these circumstances such stems acquire the characteristics of a seedling tree, but the evidence is unhappily against this assumption, for these root-suckers announce their abnormal condition by flowering and seeding at an age far too early for a seedling tree.

6. It is evident, therefore, that if we wish to maintain a coppice forest, even for so long as nature will permit the continuance in one locality of one species, we must arrange for a renewal of the root systems which represent our capital ; to do this we must provide seedling stems and to this end, as planting over such immense areas is out of the question, fertile seed and a suitable soil are necessary. If we may judge by the fact that, in spite of profuse flowering, the presence of seedling growth is almost always absent in coppice forests, we are forced to the conclusion that, in the majority of cases, either

infertile seed or unsuitable soil is the cause of failure of reproduction; we may even surmise that both drawbacks are present, the former being the consequence of the latter; in these circumstances it may be well to consider the conditions of life typical of a natural coppice forest.

7. As before indicated the coppice forests stand in Oudh at the tail of the alluvial deposits, on no great depth of soil, and at no great height above spring level. The sub-surface soil is generally composed of pure river sand which in the low-lying localities is found even on the surface. The formation of the coppice growth may in such circumstances be attributed to nature or to the action of man, but most probably never to the latter entirely; for the completeness of the operations where not a single uncoppiced stool may be found over very large areas, points unmistakeably to some influence more universal and thorough than that of the average Indian peasant. When it is asked why the coppice forest is able to withstand adversity destructive of simple seedling growth, it may be remembered that the former is remarkable for its vigour during the first years of life, so that a few feet of height, which the seedling takes many years to attain, is reached by the coppice shoot in a very short time; and that a comparatively small height growth is sufficient to place the plant out of danger from frost, fires or cattle. The coppice forest once established almost immediately forms a complete canopy and, suppressed stems gradually dying down, it presents after 20 to 40 years of existence the appearance of a fully stocked pole forest with no undergrowth, the stems being of medium height and so tightly packed as to prohibit

all chance of reproduction from seed. As the individual stems do not increase beyond a certain size, it appears probable that such forests remain unchanged for an indefinite period, for though nature may create a coppice forest she does not arrange for a periodical renewal of the coppice shoots, nor does observation of such areas tend to show that a seedling forest takes the place of the coppice growth.

8. If then it is the case that nature provides no natural reproduction in coppice forests; if it is the case that infertile seed on unsuitable soil, or both, combine to prevent the continuance of these forests; if we are debarred by the magnitude of the work from planting out these areas and so renewing our stock, it would seem that the only method of regeneration is by the sowing of imported seed which might, provided the soil was suitable, meet the needs of the case.' But before deciding on extended operations with the sowing of imported seed, certain simple experiments will be necessary which must be carried out by a responsible officer. These experiments would be to decide :—

- (i) whether seed from the coppice forest will germinate and continue in soil obtained from the coppice forest;
- (ii) whether seed as above will germinate and continue in soil from a sal high timber forest in progress of regeneration from seed; and
- (iii) whether seed from the high timber forest as above will germinate and continue on the soil of the coppice forest.

If the first is the case we have merely to encourage those conditions which tend to render the regeneration

successful; if regeneration from seed from a distant forest is feasible, our task is still easy; but if the soil of the coppice forest refuses to nourish either the local or imported seed, we are justified in concluding that, without a period of repose, the reproduction of sâl in the area is impossible.

On the most suitable method of treatment.

9. Proceeding now to the general consideration of the most suitable method of treatment to be adopted, we have to decide on the advisability of retaining standards and on the length of rotation to be prescribed.

We may start with the assumption that the more light we afford the better and more rapid the growth of the shoots; but, true as this may be, we are, at least in Northern India, prohibited from clear felling for the reasons before quoted, that we do not desire to expose the young crop to excessive climatic influences, whilst at the same time by reserving standards we favour, if we cannot compel, reproduction from seed, besides probably increasing the value of our outturn by including a small percentage of building timber in the crop.

The diminution in the outturn of the main crop need not, however, be large; a very slight and partial canopy will entirely obviate some, while mitigating the effects of other adverse influences; for in practice it is found that 60 stems of the 4th girth class per acre provide sufficient protection for the undergrowth. Experiments have been made with varying numbers of standards from 200 to the acre downwards, and the differences in the behaviour of the crop under shade of varying intensity can hardly be realized without being observed over long periods. In more than one instance in Oudh it has

been necessary to remove superabundant stems by subsequent operations in order to induce a vigorous growth of coppice shoots. We may thus safely say that in a sal coppice forest the retention of standards is beneficial in every way, but that these standards should be as sparse as possible provided that the main objects of their reservation is attained.

10. The length of the rotation will of course be fixed with regard to the size of the produce which it is desired to obtain. That of 20 years adopted in Oudh will probably in the second felling period be found too long for the purpose required; but our experience was small, we were treating for the first time forests which had been protected and at rest for some years, and it is difficult to decide in advance how much has been gained in vigour of soil and how much lost by permitting our coppice stools to age in the insufficient labour of maintaining the vitality of a single coppice pole which shows no perceptible growth increment.

On the causes which stimulate or retard the coppice growth.

11. These may be divided into causes beyond or within our control, and amongst the former may be mentioned the condition of the soil, the height of the spring level, and the season of felling; whilst amongst the latter may be cited the number of standards, their height, their age or girth, the density of the forest and the method of felling.

12. We have already considered the question of the condition of the soil from the point of view of its suitability for regeneration from seed, but it is in practice evident that the soil may be unfit for the continuance

of the seedling and yet be able to support a coppice growth of great vigour; thus it would appear that, within certain limits, this growth is not seriously affected by the richness or depth of the surface soil. These remarks are induced by observations made in at least two areas of high timber forest, where by excessive removal of the canopy in improvement fellings a coppice forest has been formed against the wish of the operator. The growth on those areas showed no greater luxuriance than in forests standing on much poorer and shallower soil where the coppice stools were also as numerous. So far then as experience goes in Oudh, unless the soil is exceedingly poor, the growth of coppice shoots, other influences being equal, is not markedly affected by the condition of the soil except perhaps in the first years of growth. The reason for this is not far to seek. The number of shoots proceeding from a stool of ordinary vitality is generally two or less, frequently three; of these one at once takes the lead and, unless the forest before coppicing was very open, the coppice stool is called upon to supply nourishment to only one stem. This feat is so considerably within the limit of its powers that it can be successfully undertaken without any necessity for phenomenally rich soil. There is of course a limit to these conditions, for when we have a soil composed of pure river sand, with merely a trace of vegetable mould and little or no surface covering, the growth of coppice shoots will be so poor as to prohibit their rapid height growth above the frost level, with the result that the crop is killed off annually by the effects of a severe winter climate and no progress is made. Such cases are, however, local and rare, but go to show that

whilst the condition of the soil may in exceptional cases influence the coppice growth, yet as a rule the root system is sufficiently extended to afford even in inferior soils sufficient nourishment to provide for a fairly vigorous growth in the coppice shoots.

13. The depth of the spring level from the surface, so important a factor in the culture of high timber forests, has also little effect on the well-being of coppice growth, for we do not wish to stimulate beyond a certain point the growth in height of our coppice shoots as in the case of seedling stems. We require trees of a low maximum girth and desire that this girth should be attained within a limited period of time; both these requirements are prohibitive of the formation of stems with long boles. In point of fact with a high spring level the growth of the coppice crop in the first year at least of its existence would appear to be abnormally good; and here again the treatment of sâl forests in unsuitable surroundings for the production of timber is clearly indicated.

14. The season of felling has above been noted as one of the conditions over which we have no control and the reason for this is that theoretically we can fell when we please, but in practice we can only carry out these operations when the forests are habitable and labour available. This season is from October to April in Northern India, and happily for the forester it coincides with the period of the cessation of vegetative activity. The matter is not one which necessitates any deep research, for we know that the fellings should proceed when, in popular parlance the sap is down and that preferably they should be completed at least a

fortnight before vegetative activity commences so as to permit the root stool to recover from the severe treatment to which it has been exposed. Knowing the period of the commencement of vegetative activity and the time when labour is available, the forester can make his own arrangements as to the period of felling, being aware that if he infringes well-known rules, equally well-known results will follow.

15. Amongst other causes influencing the coppice-growth which are under our control, the number of standards reserved has been mentioned, and this question has also been touched on in paragraph 7 preceding where it has been remarked that as few stems as will possibly serve the objects we aim at should be reserved. The number of these stems, however, must be largely dependent on their age and size. The tendency has up to the present been to retain the largest and stoutest stems, but this is not in every case to be encouraged. For seed-bearers indeed such stems are desirable, but 2 or 3 to the acre would be sufficient for this purpose; the remainder of the reserves should preferably be of small size and not of too great age for the following reasons. First, high shade is not required for the protection of the young crop which is only exposed in the first few years of its growth to adverse influences; secondly, it is preferable to maintain many small stems than few large ones, for there is thus not only more equal diffusion of shade, but also the effects of accidents such as windfall and fires are better withstood; finally the age or size at which the sál ceases to coppice satisfactorily has to be considered, for it is probable that if we select all our standards from the largest trees we shall find at the close

of the rotation that many of these are past their prime for producing coppice-growth. It is naturally a serious matter if we reduce by our own action our capital as represented in coppice stools, more especially if reproduction by other means is difficult or impossible. To recapitulate therefore it is recommended that standards should be as few as possible for safety and that, after providing for seed-bearers from those stems most resembling seedling growth, the remainder of the reserves should be from vigorous stems of smaller size and presumably less age.

16. With regard to the age or girth of the standards there is little to add to what has been written in the preceding paragraph. It is at present in our coppice forests impossible to fix the age, and our observations must be confined to the size of the trees reserved, for it is not always the oldest tree which is represented by the largest stem. The commencement of operations in the coppice forests of Oudh found us with little knowledge of the forests we had to treat. These consisted for the most part of the typical pole forests described in paragraph 6 of this note, and we were neither aware how long these had stood in that condition nor had we any idea of the age of the stems or of the root system. We have since found by experience that in some localities the most vigorous coppicing age of a percentage of the stems is past, and that the reproduction of coppice shoots is not so good as the appearance of the forest would have led us to expect. We view, therefore, the commencement of operations in forests composed of 3rd class trees with some diffidence, and we feel that, if we intend to work them on the system of coppicing, we should lose no time in commencing the treatment even if our haste precludes our waiting for high prices for the outturn;

the maturer stems should be felled as soon as possible retaining, as before mentioned, only a few for seed-bearers.

17. The density of the crop of coppice shoots is not necessarily dependent on the density of the forest operated upon; it is much more the consequence of vigour in the individuals composing the forest. Disappointment often follows the coppicing of densely stocked areas owing probably to a decreasing vitality from age or other causes in the root systems. Yet density in the crop is to be desired for it affects the growth beneficially in various ways; fewer standards are then necessary for protection; there is more rapid height growth in the shoots, and protection from cattle and fire is more certain. It must not, however, be inferred that the final outturn of the coupe is in direct proportion to the density of the crop during the first few years; we undertake no intermediate thinnings, we gain nothing from those carried out by nature, and our final results in a fairly well-stocked and in an over-stocked coppiced area would be about equal; we have merely the advantages above indicated during the period of the ripening of our crop. In areas where, owing to the sparseness of the forest worked over or to the refusal of the stems to coppice, the growth does not cover the ground, excessive growth of grass is permitted, and nothing can be done, in the event of regeneration from seed being impossible, but to encourage the growth of other trees and shrubs which are frequently eager to occupy areas where sal declines to exist.

18. We come now to the method of felling on which perhaps too much stress has been laid in the past. It has been laid down that all stools are to be cut level

with the ground, that they are to be smooth and slightly sloping from the centre; the use of an adze has even been advocated to produce these effects. These are theories which cannot be put into practice over thousands of acres, nor are they necessary. So long as the stems are felled at ground level the stools may well be left to themselves, and even if they are cut some inches above ground level, no great harm is done provided they are not approaching the limit of coppicing age. In the case of stems whose coppicing power is doubtful greater care, however, should be taken; so far as is possible the abovenoted prescriptions may be enforced. It has been noticed in such stems that the bark at the surface of the ground readily dries up and separates from the sapwood and that it is then hopeless to expect reproduction from coppice shoots, although perhaps the appearance of root-suckers may prove that some vitality is still left in the root system.

*On the management of the Fellings and control of
Export.*

10. We may conveniently close these notes with a few details of the practical working of coppice forests and export of fuel; and first it is essential that the divisional forest officer should know some six months in advance what the demand from his division will be during the coming year, so as to enable him to mark the standards on the felling areas and arrange for labour and carriage in case the delivery of the fuel is to be carried out departmentally. As the sums involved in these operations are considerable, and invariably over £2,000 in amount, it is preferable that after due enquiry as to the estimated outturn from the coupes of the year, contracts

with public companies should be drawn up in the head office and sent to divisional offices when executed. When coppice areas are sold in small allotments to local contractors, the divisional forest officer will be in a position to enter into the necessary agreements, which, in Oudh, are on printed forms, fixing the method and period of payment, the method of felling and period of removal, besides prescribing various penalties for infringement of protective and other rules.

20. The agreements being duly executed we have to consider whether departmental operations are necessitated; whether the purchaser carries out the work or whether part of the work, such as the felling, is to be performed by the department and the remainder by the purchaser. And it may here at once be said that departmental fuel works result in the greatest strain on the staff which is prevented thereby from attending to its mere legitimate duties of protection, improvement and collection of revenue. They cause also an immense expenditure to secure a disproportionately small profit, and give an opening to fraud and oppression calculated to bring the department into bad odour. The system of petty advances to hundreds of cartmen and the necessity for the upkeep of depôt stock forms result also in an enormous increase of clerical labour besides saddling the divisional officer with an irksome and trying responsibility. It is, however, generally the case in India that Government is called upon to prove that a new departure in trade can be made a financial success, and this proof is nowhere more difficult than in fuel operations where the movement of enormous masses of perishable and inflammable material is involved and where,

moreover, the purchaser considers himself hampered by the few sylvicultural rules insisted on, and has also to expend large sums of money before his produce is disposed of. Thus, when in spite of all the drawbacks of the system, the welfare of the forest and the necessity of supplying the requirements of public industries justify or indeed compel the department to undertake work outside its ordinary sphere of action, the results in the improvement of the forest and the encouragement of public industries, as well as the financial results of the future, are more to be considered than the immediate increase of revenue in the division.

21. The first improvement in the system of working is to restrict departmental operations to the actual felling, leaving conversion and removal to the contractor; further progress would be made when all operations are carried out by the purchaser who pays on the amount of produce exported; and when the felling area is sold by the acre and the duties of the forester are limited to marking the standards and general supervision of the work, we have reached the object of our endeavour in creating a market and controlling its supply. All these systems are in force in Oudh, and it is hoped that within the next few seasons the last and best will be the custom of the circle, for not only thereby are the drawbacks to departmental working avoided, but also the whole output is at once disposed of. That this is a most important matter will be gathered when we consider the case of a forest officer being called upon to supply, say, 200,000 maunds of railway fuel delivered alongside the railway line. He has to provide that quantity of sal wood in lengths of 3 feet and in diameter from 3 to 9

inches and he finds himself burdoned with an equal quantity of fuel unsuitable either as regards quality or size which he must also dispose of. He has before him the task of felling, billetting, stacking and carting 400,000 maunds of fuel which stands at his risk until the better quality is taken over by the Railway Company, and the inferior kind is purchased for other less exacting industries. We know that the regulation of the price of large quantities of perishable material which has been brought to market at a great outlay is in the hands of the consumer rather than of the seller and we can judge of the strain recurring year after year on the forest staff when fuel operations of this magnitude are undertaken departmentally.

22. The disadvantages of departmental working of coppice forests having been, it is thought, sufficiently dwelt on, the minor drawbacks of sales by outturn may be considered. The danger in this case is that the purchaser should extract the best material and shirk the felling or removal of the inferior produce which would thus be wasted. There is also a tendency to extend operations over lengthy periods of time nominally under the pretext of difficulty in procuring labour, but in reality so that the purchaser may not be called upon to pay until he has received payment for his produce. These inconveniences can be combated by insisting that the fellings proceed regularly over the felling area and by giving power under the agreement for interference by the forest officer when, in his opinion, satisfactory progress is not being made. The first regulation is indispensable in all fuel fellings, for thereby alone can the progress of work and the probable outturn be speedily and accurately measured.

28. The standards should be marked in the summer preceding the fellings, preferably with a hammer as giving more permanent results; marking with paint or whitewash is liable to obliteration in the rains, and when fellings are for any reason deferred, the work of selection may have to be again undertaken. The fellings can proceed as soon after the cessation of the monsoon rains as possible; they will present little difficulty nor do they require much supervision after the first few seasons of working when the axemen have learnt what is required of them, and that infringement of the rules laid down for their guidance is likely to result in unremunerative repetition of their labour. So soon as the fellings have commenced, such poles as suitable for building purposes should be barked; a delay of a few weeks at this period will result in the bullocks losing a large percentage of their value, whilst the bark which is now largely used for tanning will also become useless. At present fuel is more valuable than bark, so that only building timber is stripped in the fellings. The billetting gangs follow the fellings, converting the stems into contract sizes, and they in turn are followed by the stacking gangs who build up the billets into stacks of prescribed dimensions in the forests. This latter performance is in itself apparently a waste of time and labour, but it is indispensable because (i) all axemen are paid by the stack; (ii) the outturn of the coupe is then known and entered in the stock register; and (iii) the subsequent work of carting, if carried out departmentally, is checked and controlled. The conduct of the fellings is simple and mechanical; they may well be undertaken by the department, especially when fuel coupes are sold by area

and the purchaser is exposed to the temptation of over felling or of hasty and indifferent work.

24. It has been found in practice that it is often advisable to allow the stacked fuel to remain in the coupe until the following working season for the reasons that it becomes seasoned and therefore lighter, and because the working season is too short to allow of felling and carting to be completed over the same area. The drawbacks are keeping the coupe open for two seasons and danger from fire, but as green fuel will burn sufficiently well, this danger is not so serious as it might seem, whilst there is better control when carting is proceeding in one coupe and felling in another. Working-plans should provide for such contingencies which involve interference with the felling area for more than one season.

25. The carting is paid for by the stack delivered at depôt, and this involves re-stacking even if the fuel is sold by the railway wagon load. But, as this appears inevitable, it is well to consider the advantages it confers. As the number and quality of stacks in the fellings are known, it is easy at any time to check the amount of fuel left in the forest—an important item as the carters unless sharply supervised remove only the upper half of the stacks which can be thrown down on to the cart, leaving the lower half which must be lifted up. The cost of carting is often extremely heavy. The purchaser from departmental fellings gives 8 annas per stack per mile of distance led, but this does not cover the cost of carriage. A two-bullock cart will remove a stack of 400 cubic feet fuel weighing probably 125 maunds on a six-mile lead in one week, and will not be

content with a payment of less than R4 to R5. The felling and conversion cost another R5 per stack, so that at a sale price of R12-8-0 there is not much profit to be made by Government. With native contractors, however, the margin is probably much larger; they possess often peculiar attainments in compassing the acceptance of material of quality and quantity which would not be received from European officials.

26. Finally, the question of railway carriage is to be considered. There are on Indian Railways no open fuel wagons, and the closed wagons will not, without very careful packing, hold the minimum load charged for. Careful packing is impossible on account of the extremely short time, generally two hours, allowed for loading up a special train of 10 wagons. The consignor, therefore, cannot calculate on reaping the full advantage from the seemingly low rates per wagon per mile which are offered. Moreover, he is again a loser if he is consigning fuel within the minimum distance for which these rates are granted. Again, fuel traffic is only allowed when no other more remunerative traffic is available. Throughout the spring, summer, and winter the movement of grain is being carried out, and wagons may be only available in the autumn months when the unhealthiness of the country renders the work of delivery difficult and expensive. Lastly, the railway officials have always the power by raising rates to bring the slight profit on fuel operations to the vanishing point, and they exercise this power if it is in any way advantageous to their interests.

27. It will be seen from the above that fuel operations are of the most troublesome and least remunerative

of those that the forest officer is called upon to undertake; the interest that may be afforded in carrying them out will be dependent on the sylvicultural rather than on the financial point of view taken. But there is still much to learn from observation of coppice forests, and these short notes may serve to indicate the directions towards which such observations may usefully tend.

LUCKNOW :	}	S. EARDLEY-WILMOT,
<i>The 25th December 1898.</i>		<i>Conservator of Forests.</i> <i>Oudh Circle,</i>

NOTES

ON THE

REGENERATION OF SAL.

The subject for consideration in these notes is the regeneration from seed of a ruined sal forest ; the example, the Gulra and Bhinga Working-Circles of the Bahraich Division ; but it is not proposed to make any lengthy addition to the voluminous correspondence already existent on the management of these forests ; and if a concise history of the past is here necessary, it is solely with the object of obviating detailed research amongst ancient folios.

In 1875 then, this area was in a condition sufficiently deplorable to give some grounds for the contention that it should cease to exist as forest, and be handed over to the Revenue Department as waste land, ultimately, no doubt, to be transformed into what is known as smiling fields. The resort of cattle breeders, infested by wild cattle, surrounded on all sides by old established cultivation, the forests presented the forlorn aspect of a sparse overwood of mature or decaying trees, with here and there patches of underwood consisting of thorns, rohini, dudhi, and other worthless shrubs. The surface soil, exposed and bare, was hardened and impoverished to that extent that regeneration had become impossible, even had the seedlings been afforded protection from forest fires and from the herds of half-starved cattle which ranged throughout the area.

It appeared thus at that time almost hopeless to attempt to demonstrate that rational treatment, even if long continued, would clothe the soil with vigorous forest growth ; but unless this could be done the alternative was obvious ;

for either the Forest Department must restore the forest, or utilization of the area in other ways would follow. The first trial closure was, however, made in 1875, and for 23 years the forest officer, pertinacious to the creed that he should hand to his successor an undiminished and improved area, wrestled with successive Governments and with relays of revenue officers with the result, in 1898, that 17,111 of a total of 39,040 acres are closed to grazing, that the cattle breeder has almost disappeared, that wild cattle are diminished by some 700 or 800 captures, and lastly, that, as a natural consequence, the quality and vigour of the forest has improved.

It is with the last alteration in the aspect of affairs that the prescriptions of the working-plan and their results. we have to do. The working-plan which was compiled in 1893 prescribed for these closed forests light improvement fellings consisting in the removal of those trees which had become a source of injury to the growing crop, but the necessity of the preservation of a complete cover was impressed, to which end the growth of (failing sal) inferior species was to be encouraged. Insistence on this point had indeed become the main article of faith with the Bhinga forester. He had exerted all his energy to provide a complete canopy; he had for many years seen his efforts apparently unrewarded, yet ultimately he had been rejoiced by a harvest of grass, thorns and shrubs of various kinds which served well enough the purpose of sheltering the surface, impeding evaporation, retarding the flow of water, and collecting the vegetable debris formerly drifted hither and thither by the summer winds or burnt in the forest fires. The protection afforded by this poor miscellaneous growth had gradually resulted in the wished-for amelioration of the soil, and it is small wonder if it was jealously maintained. That the soil had improved was known by observing that not only did sal seed germinate, but that germination was followed by the continuance of seedlings which might be counted at first by units, but, as years passed on, by groups; so that finally it could be, truly said,

at least of the older closed areas, that the object of closure had been partially attained and that regeneration from seed was in progress. That sufficient stress was not laid on this fact by the working-plan officer was probably because five years ago little advance had been made in this direction, but, be that as it may, the treatment of large areas by light improvement fellings, consisting in the removal of a small quantity of saleable material from the coupes, followed since last season by light departmental thinnings and cleanings, did not have that effect which was expected from these operations.

Investigations frequently carried out by the divisional forest officer, and repeated in the company of the conservator in November 1898, verified the statement that the occurrence of seedlings was local and most frequent along the edges of grassy blanks and under the dense shade of the taller growth of rohini, karaunda, and other shrubs before mentioned; but much rarer in open grass patches and amongst the shrubby growth of inferior height; whilst in many low-lying localities none were discoverable. It is not implied that these seedlings were all of recent germination, but merely of recent assertion. So far as our purpose is concerned, it is immaterial if their root system existed 25 years or only 5 months previously; but before proposing a change in the system of light improvement fellings over large areas, we had to determine the reasons for the preference shown in choice of locality by these seedlings.

The following conclusions were then arrived at:—

- (a) Seedlings were wanting in localities where the soil had not become suitable for their continuance.
- (b) Seedlings were scarce in the open grass lands because the soil there had, owing to the want of overhead protection, not improved equally with that under cover.

(c) Seedlings were scarce under the shrubby growth of inferior height and age because the sal cannot tolerate low dense shade.

(d) Seedlings were more numerous along the edges of grassy blanks and under the shade of the taller and older growth of shrubs because in both localities not only was the soil richer but also more light was available. Such illumination need not necessarily proceed from above but must inevitably come from the sides.

The inference drawn from these conclusions was that in places where regeneration is not assured but only commencing, the removal of the low cover which has nobly fulfilled its part is indicated, and that such removal should be carried out with no uncertain hand. This is absolutely necessary to ensure the formation of an advance growth which will otherwise remain suppressed, although all other conditions are suitable. The high canopy, formed irregularly throughout the forest principally by the scattered stems of the principal species and other trees of inferior value, will not for the present hinder the crop of the future. In a short time, dependent on the rapidity with which the sal reasserts itself, this cover also must be removed; it has no value save that of producing seed bearers which are, however, numerically in excess; for the present our aim must be to remove with rapidity, but with circumspection, the cover we were at so much pains to create wherever this is oppressing the seedling growth. In such localities the greatest stress should be laid on the prescription "thin out miscellaneous species and thorns, where the only hindrance to reproduction is in the thick growth on the ground."

In those areas on the other hand which were closed later on and where the cover is incomplete and the soil is covered for the most part with a crop of grass, we have merely to

Proposed temporary abandonment of the prescribed fellings.

encourage by every means in our power the shrubby growth which has done us such good service in the areas which were first taken in hand. . We may do this by sowing the seed of the rohini, karaunda, and other species which we know by experience thrive in circumstances not sufficiently favourable for the growth of sal ; and we will, when so engaged, be continually looking forward to the time when we shall, as in the case of the first closed areas, be justified in removing the crop we are now at pains to create. It appears evident, therefore, that the change in treatment which was, as above indicated, portended in the tardiness with which sal regeneration, once started, proceeded, should consist in abandoning for the present the light improvement fellings over large areas and devoting our attention to more detailed operations to be carried out locally according to the requirements of the case. In open grass lands where improvement of the soil is not evidenced by seedling growth, the formation of a protective cover is indicated ; along the edges of blanks where regeneration is in progress more light should be afforded from above, and where seedlings are established under the dense shade of shrubby growth, especially where this is low, such growth should be removed. We must in fact adapt our treatment no longer to generalities, but to particular requirements if we wish to reap to the full the advantage we have already gained ; and as we have already operated on four coupes in the general way prescribed by the working-plan and without the insistence on detail which now appears necessary, it appears indispensable that we should now retrace our steps and for the next few years confine our attention in these forests to aiding the work of reproduction which is now at a most critical point.

It is probably seldom that it is given to a forester to fol-

Conclusion.

low the changes in forest life which have been indicated above ; to watch the springing up of grass and miscellaneous growth and the gradual amelioration of a barren soil ; to

compare the results of protection and continued ill-usage in adjoining tracts ; and finally to note the slow reappearance of the principal species and its quiet spread over the earlier protected forests. It is strangely gratifying to know that the opinion, shared even by some forest officers, that the Bhinga forests will never be any good is well on the way to refutation, and that the experience of the past gives us confidence for the future. That experience teaches us how necessary is a correct discernment of the time when complete cover may cease to do good and become actively harmful to a growing crop ; and also the error of attempting to leave the canopy intact until reproduction is established. In this instance more than in most we have an example of how the wished-for results might be delayed by adhering to this precept ; but in every forest, given fertile seed and suitable soil, we provide best for the welfare of the advance growth if we make early provision for its upward growth, whilst at the same time prevent a too rapid lateral expansion.

LUCKNOW ;

S. EARDLEY-WILMOT,

22nd November 1898. Conservator of Forests, Oudh Circle.

REPORT

ON

SENILISATION OF WOOD.

BY

E. R. ROBSON, F.R.I.B.A., F.S.A., F.S.I.

REPORT ON SÉNILISATION OF WOOD ; BY E. R. ROBSON, F.R.I.B.A., F.S.A., F.S.I.

In accordance with instructions, I have visited the works of the "*Société Anonyme pour la Sénilisation rapide des bois et matières fibreuses*," and have there witnessed a series of experiments and demonstrations of the process "*Nodon-Bretonneau*."

It is, in reality, a method of seasoning wood by the aid of electricity. The first of its kind.

Having been familiar for half a century with the enormous difficulties which have always beset the thorough, final, and innocuous seasoning of timber, so as to render shrinkage and warping impossible, by a method not itself introducing the seeds of decay ; having myself believed time to be the natural and only true medium, and having observed the failure of all the various attempts hitherto made on other lines, I may frankly premise that I approached this investigation in the full expectation of not being able, at most, to do more than admit the process to be a step in advance. Hitherto, all processes have failed to penetrate fully to the middle of the timber, or have succeeded only at the expense of impaired quality, or of converting the wood into something else—say lignite. One and all were too unnatural, too unscientific, too incomplete, and too expensive for general use.

The genesis of this new process appears to have been that during the year 1896, Mr. Albert Bretonneau, manufacturer of pipes and wind instruments, sought to effect improvements in clarinet pipes, and to that end caused experiments to be made with the aid of M. Albert Nodon, Engineer, formerly of the Observatory of Physical Astronomy of Paris, and now attached to the Laboratory of Physical Research at the Sorbonne. The first result was the production of the "*Bretonneau pipes*," whose superiority is admitted.

This success caused M. Nodon to suggest the application of the same principle to all woods and wood fibres. Finding a laboratory insufficient, a workshop was taken at Puteaux, 47, Quai National, where experiments were carried on with marked success. Finally, M. Nodon succeeded in effecting the removal of sap from large timbers, and their permeation with an aseptic solution, by the aid of two processes of electricity. The invention was then protected by patents. (See "*Notice industrielle, &c.*" "*Les Brenets*.")

A company was accordingly, on April 29th, 1898, brought out in Paris, with a capital of 1,200,000 francs, in shares of 100 francs.

These, so far as issued, are now quoted at 425 francs. Admirably-planned shops are in course of erection, which, with the necessary machinery, capable of working at 100 volts, will cost about £8,000, with a capacity of treating 2,700 cubic feet per day. The charge for treatment is to be 5½d. per foot, while the cost price is only about 2d. Taking a full day's work at 8d., this would give a profit of £38-15s. per day. It may be noted that the price will, naturally, be varied according to the bulk and character of the wood treated.

The application of the process is very wide and far-reaching, including railway sleepers, street paving, school desks and fittings, block floors, parquetry, all kinds of carpentry and joinery, cabinet making, wheels, casks, shipbuilding and fitting, works of art, organs, pianos, violins and other stringed instruments, pipes and wind instruments, and, in short, every purpose to which wood of any kind, size or quality is, or can be, applied. The results claimed are :—

- (1) Saving of time. One month's interest on capital, instead of years. In the case of hard woods, such as oak and yew, many years.
- (2) Power of utilizing cheap or damaged woods, hitherto almost useless, and of applying them to new purposes.
- (3) Facility of dyeing woods to prescribed colours throughout their entire thickness, and rendering painting unnecessary.
- (4) Gain in treating green woods without loss of time. The greener the wood, the quicker the action of the process.
- (5) Complete freedom from shrinkage, twisting and warping.
- (6) Immunity from damage by the insect or the animalcule.
- (7) Great reduction in inflammability.
- (8) Increased strength and better surface.
- (9) Resistance to damp or moisture.
- (10) Extraordinary increase in the resonance and fine tone of music instruments.
- (11) Economy of application.
- (12) Enormous diminution in the destruction of forests so far as arising from premature rot in the quantity actually sold.
- (13) Practicability of rendering wood fireproof, if required, at a very small additional cost, by one further process.
(See "*Notice Industrielle, etc.*" "*Les Procédés.*")

The experiments witnessed by me were made in the temporary shops, with a portable engine of seven-horse power and a small dynamo.

Process No. 1. A piece of ordinary Norway red pine was put into a quadrangular shallow tank of soapy water, immersed to rather more than half its depth, and the electric current was applied through a metallic conductor so arranged as to distribute it throughout the area. In the space of four minutes the sap commenced to exude visibly at the lower part of the end of the wood, forming a line of viscid froth. In the space of six hours the sap was seen, by the ceasing of exudation, to be entirely extracted. The wood was then taken out.

Process No. 2. (Capillary.) The second process took place immediately after the first, and while the wood was wet. The septic solution was forced from below into the pores denuded of sap by an electro-capillary method. Duration three hours.

After the two electrical processes have been completed, the wood undergoes two drying processes: (1) By being placed for two or three, or more, weeks in covered sheds, provided with a constant through current of fresh air. If of large, scantling, or obstinate nature, a longer period is allowed. (2) By being placed for three or more days in the hot, dry rooms. The processes are then all complete, after lasting about a month.

ILLUSTRATIONS.

(No. 1) I was shown a piece of ash 3' 4" x 1' 2" x 4½" which had been fully treated six weeks previously. In appearance, it presented only the ordinary characteristics of the wood, without any change. Although actually heavier and harder, it presented no appreciable difference in facility of being worked by chisel, plane, saw, or other tool.

(No. 2) In the case of a piece of oak, also fully treated, it was pointed out that the discoloured outside portions, such as are commonly called "sappy," and hitherto invariably rejected as liable to speedy rot, were here sound and capable of use, although their discolouration remained. This feature applies to all the kinds of wood treated.

[*Note.*—During these experiments, M. Locherer, Engineer in charge of the streets of Paris, was present. He expressed himself perfectly satisfied as to its suitability for use in the wood pavement of the streets of Paris.]

(No. 3) I paid a visit to M. Schneider, Furniture Manufacturer, 2, Rue de la Roquette, who explained the differences he had found, for furniture uses, between woods seasoned in the ordinary manner and those treated by the new.

(No. 4) Table-tops had ordinarily required five consecutive layers or thicknesses of wood to secure a surface not liable to shrink or warp. As a contrast, he exhibited one made two years ago, in which the wood had undergone the process, and which was

absolutely true and satisfactory, although made in only one thickness.

(No. 5) He then produced an ordinary framed house door, in which all the usually rejected "sappy" edges had been retained, because he had confidence in their durability and fitness.

(No. 6) Also, he showed a piece of oak plank from Lorraine $1\frac{1}{2}$ " thick, which, although green in March last, had been rendered, after a treatment of two months, perfectly dry and fit for use.

(No. 7) M Amédée Thibout, head of the celebrated firm of Henri Herz, Pianoforte Makers, 28, Rue Victor Masse, explained the great advantages which his pianos had derived from the use of the process. Among others, that soft woods, when "senilised," are proved to be better than hard woods seasoned by ordinary methods. Without going into the history of the gradual development of the piano as now we know it, or its complicated mechanism, he laid great stress on the *table d'harmonie*, or sound-board, as being the vital part of the actual construction and the life and soul of the higher quality of a piano. The bridge pressure on the strings being 15,000 kilos, or about 15 tons, the *table d'harmonie* was always liable to give way.

(No. 8) He exhibited one sound board which had been made from green wood, treated for only nineteen hours, and which was found to be so dry, hard and strong, that it could be used at once. In spite of the large size, the thickness was only a quarter of an inch.

(No. 9) It was afterwards noticed, with surprise, that the use of "senilised" wood had immensely improved the quality and tone of the instruments. The softer sounds had become sweeter, the louder more resonant, the whole more penetrating.

(No. 10) In approaching the consideration of the subject in relation to violins, we tread on delicate ground. Pine, as we know, is used for the belly of the instrument, maple for the other parts. The former should come from the Valtellina, the Simmerthal, the Lac de Joux Valley, Les Brasses, the southern slopes of the Jura, Bernois, etc., while the latter should be from the southern slopes of the Carpathians or the Tyrol. Also, that all these require five or six years' seasoning *at the least*.

(No. 11) Finally, in spite of the innumerable processes for depriving wood of water, acid, resins, etc., which have been tried at different times, and with varying degrees of apparent success, we find, on a high and reliable authority, that "all artificial preparations, baking and tampering," *only ultimately spoil the violin*.

It is thus clear that the new process must create a veritable revolution in violin-making, and much sensation among the makers and players, now that electricity is brought to bear. The tests of the process as applied to so delicate and subtle an instrument as the

violin are of the most complete character, and appear to sweep away all preceding methods. No more complete demonstration as to the value of the invention, in its larger uses and more commercial sense, could, in my opinion, be made than from this apparently small one.

(No. 12) M. Audinot Leuthier, of Paris, has a celebrity known to every connoisseur of violins, and was good enough to give me, in much detail, the result of his experience.

(No. 13) Pointing to a piece of wood $2'8'' \times 1'6'' \times 2''$ average thickness of Hungarian Yew, he complained that, although ten years had passed since its cutting down in bulk, it was so warped and superficially corrugated during the last twelve months, that half of it was wasted, and it had cost £1. He had no personal interest in this new treatment, but it was imperative for him to have the most suitable wood for his purpose.

(No. 14). He compared specimens of wood so treated, with other wood known to be 100 years old, and declared the former to be better after a seasoning of only one month.

(No. 15) He found it to be, also, closer in texture, finer in quality, harder, more sonorous, not so liable to take stains, and, lastly, better for receiving the varnish—so important a point in violins.

(No. 16) He had the same evidence in comparing old and new Austrian pine.

(No. 17) In point of cost he considered it far more economical than any preceding process for violins.

(No. 18) Being extensively employed to restore and repair old violins, he said he could not now do without the "senilised" wood, and exhibited the upper part of an old violin in actual process of repair, which was in so bad a state that without "senilised" wood, repair would have been impossible.

(No. 19) In one violin, the wood, 100 years' old, showed objectionable roughness round any holes or borings, while those in the new wood, "senilised," were quite true and smooth.

(No. 20) In the new instruments which he had made from wood treated by the process, he had succeeded surprisingly better than before, and now anticipated the production of violins of much higher tone and quality.

This practical testimony is proverbially worth a ton of theory. The acoustics and making of violins need not here be gone into. The first important point is the kind, quality and dryness of the wood used.

Other experts in wood may be expected to approach the consideration of this remarkable invention with an incredulity equal to my own.

Observation of the same experiments, and a careful consideration of the same evidence, cannot fail to be equally convincing.

Any fear that the effects may not be lasting are rather based on past sad experiences of other methods than upon any justification derived from the process or the probabilities to be deduced therefrom.

Durability is, for absolute proof, essentially a question of the future, and is inherently incapable of mathematical certainty in advance. Yet, here is, for the first time, a method of seasoning timber which is in harmony, instead of being in conflict, with nature; utilising, as it does, in a scientific manner that electricity of which we have yet so much to learn, and is eminently calculated to preserve and maintain the properties of wood, to enhance its quality and to prolong its durability.

I came to the final conclusion that the process is eminently successful, satisfactory and practical. That it can be applied with commercial advantage and profit to numerous purposes which require timber in bulk, while its use in small quantity for musical instruments requiring certainty of dryness and quality must be very profitable, and that it has scientifically solved a problem which has hitherto baffled mankind.

At a later stage it would be necessary to test large pieces of timber, one half treated, the other not, so as to determine accurately the increase of strength and of capacity for resisting strains.

October 18th, 1898.

P. S.—Since this report was in type I am informed that an enormous improvement has taken place, by which the two electrical processes are taken together and occupy five hours only.

NOTE
ON THE
HASKIN PROCESS
OF
VULCANIZING TIMBER.

BY
DR. J. NISBET,
CONSERVATOR OF FORESTS.

NOTE ON THE HASKIN PROCESS OF VULCANIZING TIMBER.

This process resembles the preservative processes introduced with regard to timber by Mr. Kyan, Sir William Burnett, Mr. Bethel and others, only in so far that all of these processes are classifiable as antiseptic. It differs from them *in toto*, however, with respect to the means of sterilising the woody tissue; for, whereas the other methods attain this by injection of antiseptic substances, Haskin's process aims at direct sterilisation under the immediate operation of heat and pressure.

Apart from the disintegrating and wasting influences to which timber is liable, and which it shares with iron, steel, etc., in the shape of disturbance of molecular and other forces, the main causes of its more or less speedy decay are of purely organic origin and arise from attacks of fungi and insects or other animals. Some kinds of timber have a better natural protection than others against attacks by fungi and insects through the tannic acid, etc., contained in their tissue (*e. g.*, oak, cutch, pyinkado); others have essential oils distasteful to most insects (*e. g.*, teak, deodar); and others again are more or less protected by natural processes of resinification (*e. g.*, larch, pine). Adopting a broad generalisation, it may be said that the durability of timber *per se* is in the inverse ratio of the amount of albuminoid matter present in the wood in a form which can be utilised as food material by fungi and insects or other wood-consuming animals. Rapid alternation of dampness and draught, or the combined action of dampness and high temperature, will facilitate attacks on wood by both of these classes of destroyers; but for the sustenance of life in the vegetation of fungi or in the alimentary processes of insects, albuminous food is an essential requisite. If the albumen can be sterilised and rendered unfit for utilisation as food, by being made to undergo a permanent change rendering it unassailable to fungous and insect attacks, the woody fibrous tissues of timber must benefit both directly and indirectly. They gain directly by offering practically no points of attack to saprophytic fungi and insects, and they gain indirectly by becoming thereby exempt from the destructive and disintegrating processes induced and hastened by the fermentation which accompanies the action of fungi and insects.

As a temperature of about 160° Fahr. effects the coagulation of albumen, this fact was practically adopted as the basis of the Haskin process of vulcanization. Further use was at the same time made of the well-known fact

Principle underlying the Haskin Process of Vulcanization.

that many of the transformatory and perfecting processes of nature are carried out under the application of great heat and enormous pressure. Such natural processes have been imitated, and the vulcanization process may be briefly described as a new method of rapidly seasoning timber by hermetically sealing it in powerful iron vessels and exposing it under a pressure of about 18½ atmospheres (200lbs. per square inch) to the influences of dry air superheated to between 200° and 300° Fahr, the precise temperature being the secret of the process. If the amount of heat be inadequate, the full advantages obtainable by warmth and pressure are not obtainable; while on the other hand excess of heat might induce dry distillation that would weaken the quality of the timber for technical purposes. This principle seems perfectly sound.

At the same time other organic changes take place. Through the heat and pressure applied, the constructive potentialities of the sap are utilised, the transformed portions being apparently incorporated into the woody tissue in the form of antiseptic substances. The changes that take place in this respect appear to resemble such as occur in the transformation of sapwood into heartwood, a change which enhances the durability of timber.

In coniferous woods a process of resinification is also very distinctly noticeable as the result of treatment, the production of resin in large quantity no doubt being due to the action of heat and pressure on the sap and also on the less durable portions of the cell-walls; for it is known that the chemical transformation of the latter assists in the natural production of resin.

The vulcanization process is said practically not to alter the weight of the timber to any considerable extent, and but little water is given off during the treatment. This seems to prove that the sap contained in the wood is for the most part transformed and incorporated into the sterilised woody tissue.

Method adopted.—The method adopted is simple. The timber to be operated on is brought in from the yard on a narrow tramway and run into one of the cylinders in which vulcanisation takes place. There are four such cylinders, each 112 feet in length (consisting of four sections of 28 feet each), so as to admit of treating the largest size of telegraph posts. The timber being operated on at the time I visited the yard were sleepers, of which some 1,410 cubic feet or 28 tons could be railed on little waggons into each cylinder. When deals are dealt with, the feeding consists of from 1,000 to 1,145 cubic feet according to the way they pack on the small trollies.

The cylinders are built of boiler plate and are anchored at the top end, while the other portions are supported by rollers on runners to allow play for the expansion of between $1\frac{1}{4}$ " and 2" due to the hot air applied within.

When the load of timber has been trolled into one of the cylinders, the open end is hermetically closed by means of an enormously heavy steel lid hinged at the top and heavily counterpoised (weighing in all about 9 tons), which is opened and shut by means of a cog-wheel worked by the leverage of a hand-wheel. On the lower end being brought into position, the complete closure against air-leakage is effected by means of numerous curved levers (*see* Fig. 1) radiating like the spokes of a wheel from the centre of the lid, whence the levers are actuated, and pressing powerfully on the lid so as to seal it hermetically against the air pressure of 200 lbs. per square inch from within. To facilitate air-tight closure, the lip of the cylinder is coated with asbestos packing. There are 40 of such spoke-like levers, and each fits into a strong steel socket or slot (*see* Fig. 2). The opening or closure of the lid can take place in less than two minutes, only two men being required to work the wheel and apply all the requisite leverage. The lid having been closed on the filled cylinder, steam is turned into the pipes (*see* Fig. 2) and surplus moisture from the outside of the wood is expelled and run off through cocks at bottom of the cylinder. The cocks being again shut, superheated compressed air between 200° and 300° Fahr. is then driven into the cylinder (*see* Fig. 3). This is provided by an air-compressing machine in an adjoining chamber. The air-compressing engine (Figs. 4 and 4a) has steam and air cylinders, each 18" in diameter, and (weighing about 35 tons.) with a 30" piston stroke in which the air is compressed to a pressure of 200 lbs. per square inch, while a spray of water is at the same time injected into it to absorb the heat evolved by compression. This moist compressed air is next filtered through a water separator which dries it thoroughly, after which it is pumped by the circulating engine (also of about 35 tons weight—*see* Figs. 4 and 4b) first through cylinders containing tubes heated by steam and then through a kind of pipe stove heated by a coke furnace, whence it is conducted to the cylinders where vulcanization takes place. It is essential that there should be constant circulation of the superheated air in the vulcanizing cylinders, and each complete stroke of the piston of the air circulating machine displaces 35 cubic feet of air. Fresh superheated air is forced into one end of the vulcanization cylinder and a corresponding quantity drawn off from the other end. From the cylinder the air passes to a tubular cooler and is conducted thence to the circulating pump for redistribution. Any loss of air-pressure due to circulation is replaced by the occasional use of the air compressing machine. Both the air-compressing and the air-circulating machines are worked at a slow rate.

The process of vulcanization depends of course on the dimensions of the timber to be operated on, but for sizes like sleepers it occupies about 8 hours; and no advantage has been found to accrue from continuing the treatment beyond this time. As the plant is not yet fully employed, the cylinders are fed in the morning, operated on during the day and allowed to cool at night, the load being taken out early next morning and replaced by fresh wood for treatment. If worked under pressure of a large business, cooling could be facilitated by gradually lowering the temperature of the air pumped into the cylinders.

Effects claimed for Vulcanization.—The effects claimed to be produced on wood by vulcanization are—

1. That it will not decay.
2. That the cheaper kinds can be utilised for sleepers, mine-props, piles, etc.
3. That the technical properties of wood become enhanced by strength being added and shrinkage diminished.
4. *That the resinous, oleaginous, and other properties of the sap within the cells and fibre become solidified.*
5. *That the germinative principle inherent in the fluids is destroyed.*
6. *That all "fungi", "germs", or "insects" are killed.*
7. *That wood is indurated, strengthened, perfected and rendered less inflammable.*

Numerous certificates and reports of physical tests are quoted by the Company to prove that the technical properties of the wood are enhanced, and detailed statistics are given in the pamphlet issued by them. Avoiding statistics, which can only be satisfactory to those who are acquainted with all the circumstances of the experiments for testing and comparing the treated and the untreated wood, the following remarks by Professor Myers of Stanford University, California, United States, America, appear to be fairly stated:—

"As vulcanizing changes the sap from the liquid to the solid or semi-solid state, does not char or make the wood brittle, saturates and seals up the pores of timber with solid matter instead of liquid soluble matter which nature provides, considerable strength and durability are added, the wood being rendered more cohesive, harder and denser."

Effects visible.—Samples of pine sleepers, said to have been in the ground for about 10 years, were shewn to me in a thorough state of preservation; and if they really are what they are said to be, they form a striking proof of the utility of vulcanization. During my visits to the works I had opportunities of examining Baltic pine baulks and sleepers under treatment for the Natal Government and of comparing them with the unvulcanized wood:

and I could not but remark the highly resinous condition of the vulcanized wood in comparison with that awaiting treatment. This resinification, this transformation of sap and of the less durable portions of cell walls into substances which become incorporated into the woody tissue, must increase considerably the resistance which the saturated fibres are able to offer to the natural processes of decay.

While it is easily intelligible how the transformation of aluminous substances, sap and portions of cell-walls capable of undergoing transformation under heat and pressure can and probably must increase most of the technical properties of timber, yet it is almost impossible to accept in its entirety the statement put forward that vulcanization renders wood less inflammable. Certainly for non-resinous woods this will be so, but in the case of conifers resinification must produce greater inflammability; and in all woods operated on the heating power must become enhanced. "*Inflammability*" and "*heating-power*" are not, however, synonymous terms; and for the practical uses to which vulcanization may be applicable with regard to *Indian forest produce*, this point may be left out of consideration.

Buildings and Machinery.—Both buildings and machinery are simple in construction, though the latter is solid and heavy. The former consist of two compartments and an outer shed. The shed contains the three boilers (each of 300 horse-power), only two of which are used simultaneously. In an adjoining room stand the heavy engines for compressing and circulating the air, the water pumps and reservoirs, and a centrifugal distributing pump.

The large outer compartment contains the water-separator, the heating cylinders, the coke furnace with its heating tubes, and the cylinders where vulcanization is effected.

All the machinery was supplied in 1897 by Messrs. Galloway of Manchester, who are on the Board of Directors and are largely interested in the Company. There are three boilers, one water pump and reservoir, one centrifugal pump, two air-compressing and two air-circulating engines, one water separator, four hot air cylinders, one coke furnace with internal pipes, and four large cylinders for vulcanizing. At present only part of the machinery is employed, as the treatment does not yet seem to have acquired the popularity that it deserves. From the river the timber is lifted out of barges by a crane and laid on trolleys running along a narrow tramline towards the compartment containing the cylinders, near the doors of which the load is shunted on to a line leading straight into any particular one of the four cylinders to be fed at the moment. The handling is therefore very simple.

Establishment.—The establishment now employed at the works (Samuda's Shipbuilding Yard, Millwall on Thames) consists of:—

- 1 Trained Engineer in charge of yard and works.
- 1 Machine man.
- 1 Stoker.
- 1 Boiler cleaner.
- 4 men for charging and discharging the cylinders and for general work in the yard.

The trained engineer and foreman exercises a general supervision over the whole business of the yard and sheds (including clerical work), and sees that the machinery and the electric lighting plant are maintained in proper condition. The boilers, of which only two out of the three are worked simultaneously, have to be cleaned out with soda once a week owing to the high percentage of lime in the water obtainable. In addition there are three men employed in barge work, but the above represents the complete staff required for the working of the yard and maintenance of the whole of the machinery.

Charge made for Vulcanizing.—The charge made for vulcanizing is $2\frac{1}{2}d.$ per cubic foot for soft woods and about $4d.$ for hard woods, a reduction being made for large quantities. It is therefore somewhat cheaper than creosoting. The difference in the scale of charges between soft woods and hard woods does not arise from any difference in treatment, but is due to hard woods being usually sent in smaller quantities and in forms (*e. g.*, veneers, cabinet woods, sounding boards for pianos, etc.) which involve more handling in the yard and during the process of vulcanization than sleepers and baulks of pine and fir. So far as the actual treatment is concerned, the vulcanization process is identical for both classes of timber, and mixed charges can be run into the cylinders. The *actual cost of vulcanizing* must be very small if there are regular supplies of timber to operate on.

Suitability of process for India.—Haskin's Vulcanization seems a process deserving of careful consideration in all the forest districts throughout India, where there exist supplies of timber now unmarketable owing to liability to rapid destruction from the ravages of fungi and insects. Such conditions obtain especially in hot damp climates (like Burma, for example). There can be no doubt that the effect of vulcanization on all classes of timber is to enhance its durability. Thus even the best classes of hard-woods, like the sal of Bengal and the North-Western Provinces, the pyinkado of Burma, the nageshur (*Mesua ferrea*) of Assam, and any similar woods valuable as sleepers, etc., will remain serviceable for a longer term of years if subjected to this process; while it is quite probable that inferior classes of timber, such as

the wood produced by the great majority of the forest trees throughout the wooded tracts in all provinces of India, may by vulcanization be rendered of considerable durability, and consequently of a technical and marketable value which they do not now possess in their natural condition.

This is more particularly the case when the two following facts are borne in mind :—

1. That vulcanization can take place to the best advantage when fresh, unseasoned wood is operated on.
2. That the boilers used for driving the machinery and generating the electric light can quite well be simultaneously employed in working the machinery of a saw-mill. This process could therefore be carried out wherever saw-mills are erected in the forests. Even at the maximum English rate of 2½d. per cubic foot for sleepers, this would be only 3½d. per narrow gauge sleeper (1½ cubic feet); and for this increase in price, which would probably be reduced to not more than about 1 anna per foot as the actual cost on a large scale, there would be obtained not only increased durability, but also less tendency to splitting, cracking, and breaking in handling and transport.

The only European who might in India be required to look after the machinery and the work generally is the trained engineer, and even that post might perhaps be satisfactorily filled by a competent native of India after undergoing some special training in the business.

Probable effect of Vulcanization on different kinds of Indian Woods.—It is hardly possible to predict what the effects of vulcanization may be on different kinds of Indian timber. If it causes increase in the amount of essential oil in teak and cedar, it will directly enhance their technical value, dependent as this mainly is on the essential oil contained in their woody substance. If it increases the amount of catechin, tannin or other valuable properties in woods like *catch* and *pyinkado*, it must likewise enhance their market value and enable larger supplies of tanning and dyeing substances to be extracted from them. If it transforms the albuminous and oleaginous matter in *Dipterocarpus* trees in such a manner as to render their timber durable and make them offer no food supplies to fungi and insects, then it will enable hundreds of thousands of tons of In ? (*Dipterocarpus tuberculatus*) timber to be available for sleepers and other constructive purposes. Many *Terminalia* would also yield large supplies of useful timber if treatment can be proved beneficial in their case. Finally, there are many different kinds of wood, possessing beautiful colour and fine grain which might ultimately come into favour as furniture woods for decorative purposes, if it could once be shown that ———

rendered them durable. But it is only by means of experiment and careful tests that any satisfactory conclusion can be arrived at with regard to the effects of vulcanization on each particular kind of timber.

Recommendations made.—As above stated, the system seems to me based upon thoroughly sound principles; and I am strongly of opinion that its introduction into India would enhance the durability of woods now used extensively for railway sleepers, and would probably render suitable for similar use and for various constructive purposes many other kinds which in their natural state can only be considered as inferior and unsuitable owing to their liability to rapid decay in a hot damp climate.

Before Government should commit itself to any considerable outlay in the introduction of vulcanizing plant, however, I would recommend that blocks of timber of, say, from 20 to 30 of the most abundant kinds of trees growing throughout the different parts of India and Burma, should be sent to London for experimental purposes. The best dimensions would perhaps be those of the ordinary narrow gauge sleeper. Of each kind of wood four such sleepers should be prepared, one being retained and three sent to London. Of these three, two could be vulcanized and one of the two sent back to India for submission to tests in comparison with the unvulcanized wood cut from the same block. There would thus in each case be an unvulcanized and a vulcanized sleeper (cut from the same block) in London and in India. In London and on the continental *Forstliche Versuchstationen* arrangements could easily be made for microscopical and physical tests regarding their respective technical properties; while in India the tests might be of a rougher nature, such as burying the wood in ants' nests, etc.

It might take a month or six weeks or perhaps even longer to have all the necessary arrangements and experiments made; but the promise which the process holds out as being of future importance to India seems to justify some time being spent in trying to ascertain its probable value in a practical manner. The Company have stated to me that they will be very pleased to operate upon specimens sent with a view to testing the process.

Cost of Plant and Machinery.—Colonel Haskin informs me that the cost of the plant and machinery now erected at Millwall has been about £12,000, but he is of opinion that for plant consisting of two boilers, one air-compressing engine, one air-circulating engine, one water separator, set of heating apparatus, one heating stove, and two vulcanizing cylinders, each 56 feet in length (*i. e.*, consisting of two compartments 28 feet long), with the requisite short tram line, the cost would probably be from £5,000 to £6,000. Laid down *in situ* in the forest it would in this case amount to about one lakh of rupees. Mr. Bagley, late Engineer-in-Chief, Burma Railways Company, who accompanied me on my last visit

to the works on 7th December, informs me he is of the impression that £3,000 was the sum previously stated in correspondence on the subject.

Each such cylinder would contain about 15 tons or 495 narrow gauge sleepers, and the two would vulcanize up to nearly 1,000 narrow gauge sleepers a day. This is considerably more than any small forest mill can produce.

Presuming that the vulcanizing plant and sheds, etc., cost as much as ₹1,20,000 and estimating that it was worked in conjunction with a saw-mill (from which it would be supplied with fuel), then the working would probably cost:—

				₹
Depreciation and Amortisation Fund at				
10 per cent. on ₹1,20,000	.	.	per annum	12,000
<i>Establishment.</i>				₹
1 Engineer at	.	.	350 per mensem.	
1 Machineman at	.	.	100 "	
1 Stoker at	.	.	30 "	
1 Boiler cleaner at	.	.	30 "	
4 Coolies at ₹12-8	.	.	50 "	
				560 "
<i>Sundries.</i>				
Cotton waste and oil, say	.	.	40 "	
				600 "
Occasional repairs, etc	.	.	"	
			= per annum	7,200
			"	800
Total				20,000

That is to say, for about ₹20,000 a year any number of narrow gauge sleepers up to some 350,000 could be operated upon. Even if only less than the half of that number, or, say, 160,000 were vulcanized, this would only cost *two annas a sleeper*. Speaking from my own personal experience when in charge of the Taikgyi saw-mill, from which many lakhs of pyinkado sleepers were exported *via* Rangoon to Madras and Calcutta in the years 1882 to 1886, two annas per sleeper would have been a low rate to have paid for any toughening process which would have tended to diminish loss from breakage and cracks arising from the rough handling given in discharging from railway trucks and in loading and unloading the steamers. On this account, from the manufacturer's point of view alone, the introduction of vulcanizing treatment into sleeper-mills working on a large scale would pay, if experiments with Indian timbers shew that Huskinized wood is tougher and less liable to split or crack; to say nothing of the great benefit to be derived by the purchaser in obtaining wood possessing greater durability than is possessed by the timber as now utilized by him.

Royalty.—I understand from Colonel Haskin that the Company would be prepared to sanction the use of vulcanizing machinery in India under very moderate conditions as to royalty under patent rights. This item has not been included under the estimate of working expenses given above; but this is more than counter-balanced by the low outturn estimated (160,000 out of a possibility of some 350,000 sleepers).

94, LEXHAM GARDENS, LONDON, W. }
 10th December 1898.

J. NISBET.

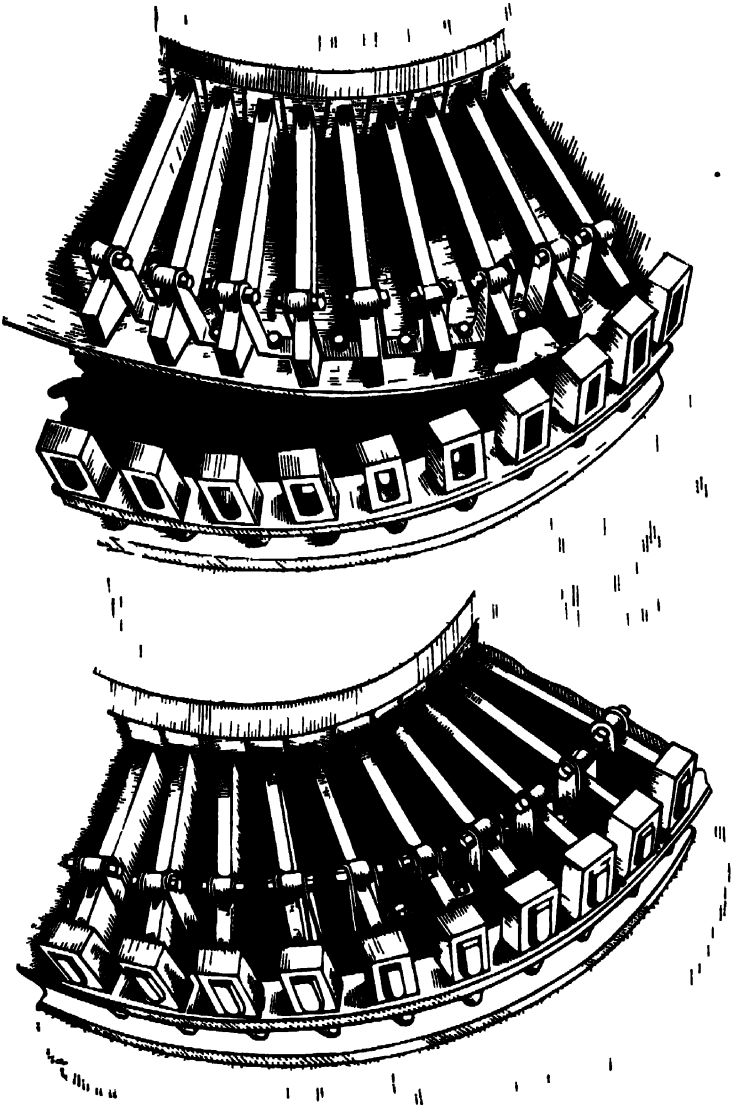


FIG 1 - DETAIL OF DOOR LATCHES

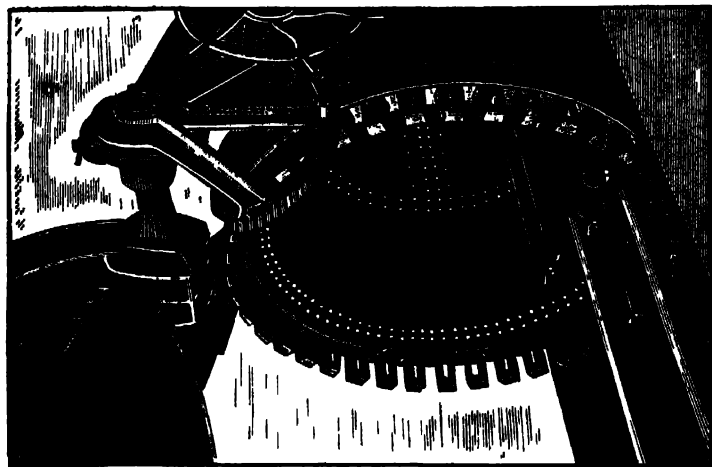
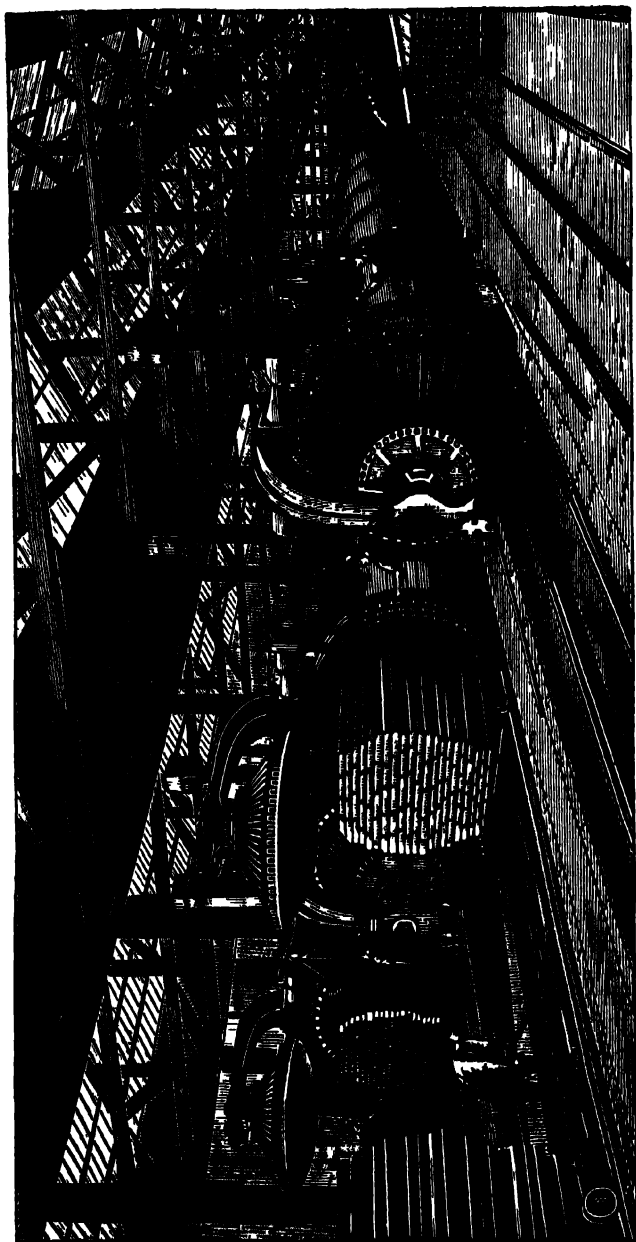


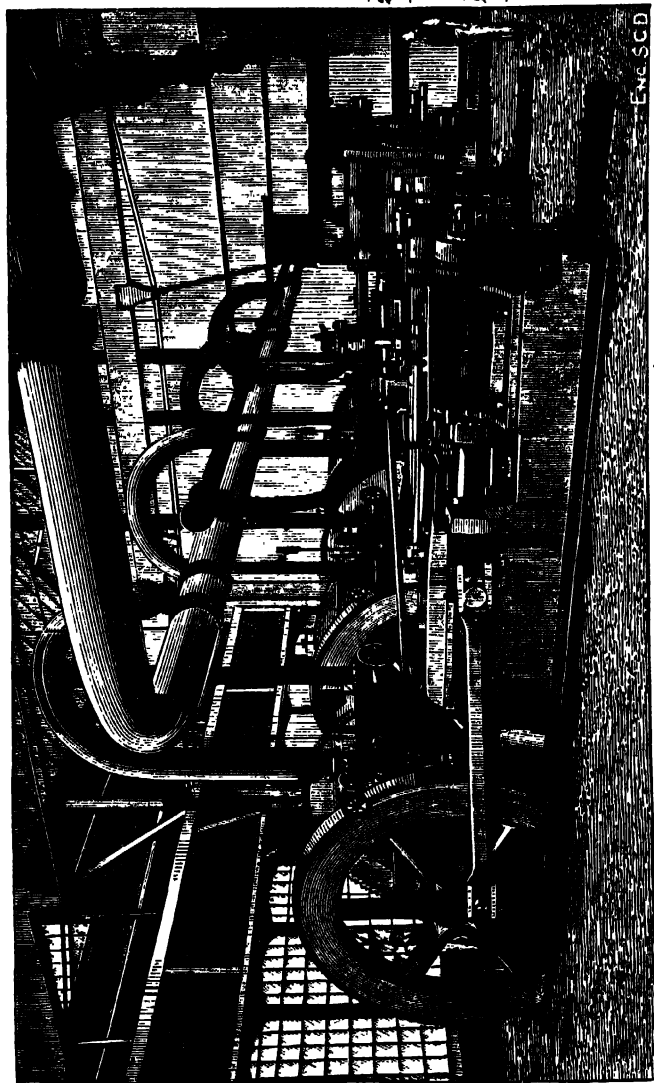
FIG. 2.—END OF CYLINDER.

FIG 3.



CYLINDRICAL WOOD TREATING VESSELS (used in the Haskin Wood Vulcanizing Company's Works).
[*Samuda's Shipbuilding Yard, Millwall-on-Thames, London.*]

FIG. 4.



AIR COMPRESSING AND COMPRESSED AIR CIRCULATING ENGINES (used in the Haskin Wood Vulcanizing Company's Works).

[*Samuda's Shipbuilding Yard, Millwall-on-Thames, London.*]

← 2 Circulating
Engines.

← 2 Compressing
Engines.

ENG. SCD

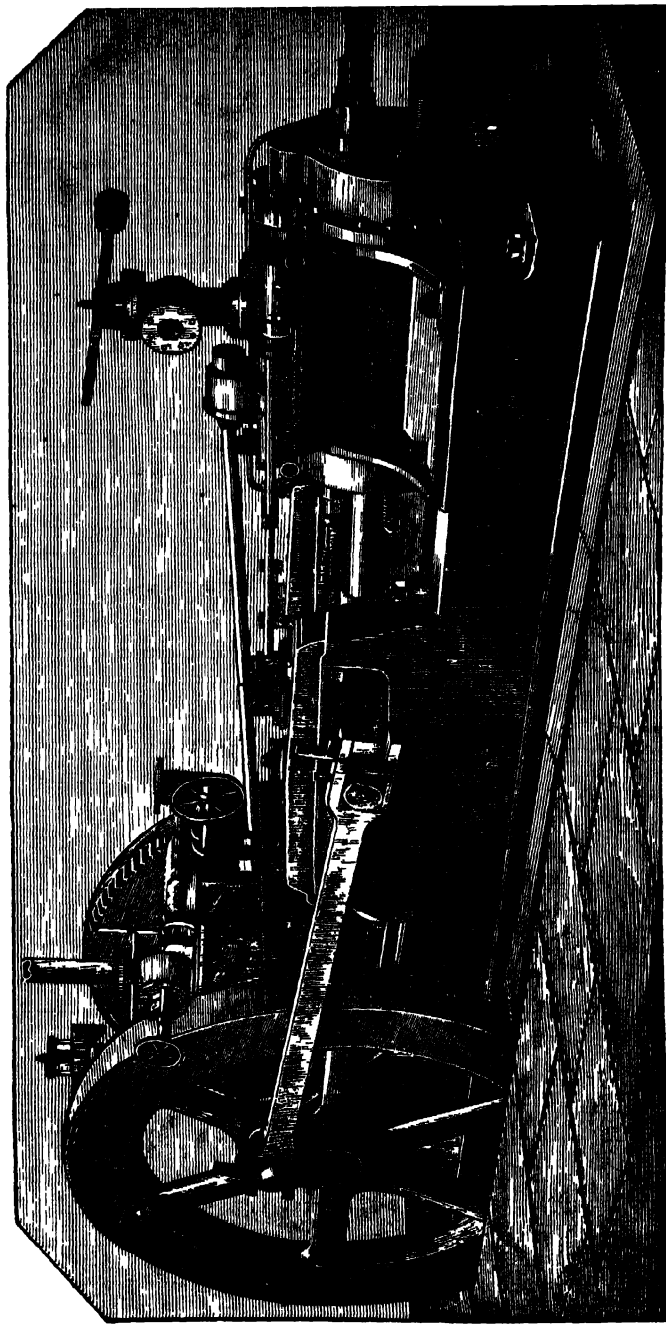


FIG. 4. —AIR COMPRESSING ENGINE.

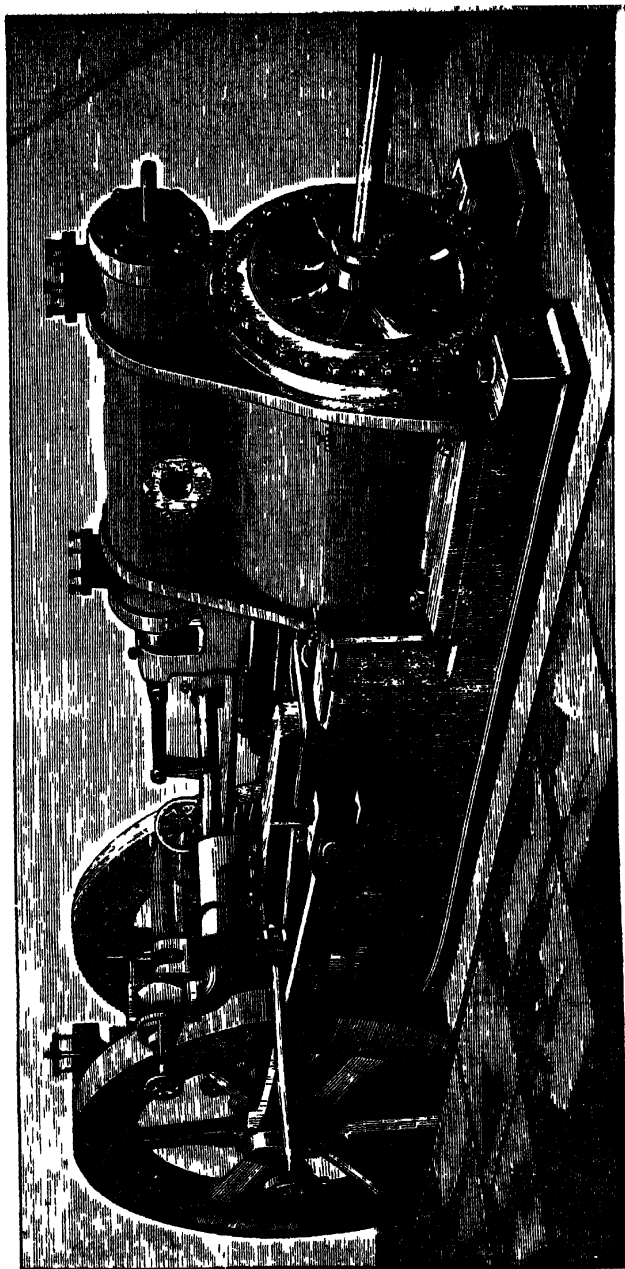


FIG 43.-AIR CIRCULATING ENGINE

NOTES ON THE TREATMENT OF SOME
EUROPEAN FORESTS

BY

C. P. FISHER.

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I.—THE TREATMENT OF SOME RESINOUS FORESTS IN FRANCE.

(A) IRREGULAR FORESTS.

(a) *Communal forest of La Neuveville (Vosges).*

THIS forest is 1,079 acres in area, is situated at an altitude of 900 to 2,000 feet above sea level, and consists of a series of rounded spurs with a general direction towards the north, so that the aspect varies continually. The underlying rock is the Vosges sandstone, and the soil is fairly deep and fresh, except on the hot slopes, where it is generally of poor quality, and dry. The species consist of 69 per cent. of silver fir, and 26 per cent. of Scotch pine, together with spruce, beech, oak, birch, larch, etc., in small quantities. The Scotch pine has been introduced artificially, and is found on the hot slopes, where silver fir is of such poor quality and growth that it was felled and replaced by the pine, which has since been under-planted with silver fir.

Previous to 1865 fellings were made—(a) by volume in certain parts of the forest, whence, according to past custom, a fixed number of stacked cubic feet were felled annually, and (b) by area in the other parts, 20 acres a year being cut over in what may be called thinnings. The result of this treatment was that in 1865 the forest looked as if seeding fellings and thinnings had been made all over it, at haphazard.

In 1865 a working-plan was made whose object was to obtain a regular high forest, worked on a rotation of 120 years, with four periodic blocks, approximately equal in area, and four periods of 30 years each. The division into periodic blocks was made without consideration of the crop in them, and simply in order that each one might be contained in a ring fence. The annual capability, calculated on the volume of trees of 13·8 inches, and over, in diameter, contained in the area to be regenerated during the first period, was fixed at 35,315 cubic feet, and the fellings, which were seeding, secondary, and final, were assigned to certain parts of the first and fourth blocks. The rest of the forest was to be worked over by area fellings, at the rate of 49 acres a year. These last fellings were either thinnings, or “jardinage” fellings, or, where it was desired to replace badly grown silver fir by Scotch pine, clean fellings. The plan was revised in 1861, when practically the only change made was to prescribe “précomptage” on the capability of the volume of all trees of 13·8 inches, and over, in diameter, felled for any reason whatever in any part of the forest: that is to say, that each year, before the volume, i.e., the regeneration, fellings were made, the total volume of all trees of 13·8 inches, and upwards, in diameter, felled for any reason in any part of the forest, was ascertained, and this volume having been deducted from the 35,315 cubic feet prescribed for the annual felling, the reduced quantity only was taken in regeneration fellings. Thus, suppose that the area fellings, windfalls, etc., had removed 10,000 cubic feet, then only 25,315 cubic feet could be taken in the regeneration fellings. The result was that, at the end of the first period, the regeneration fellings

in the first and fourth blocks were not finished, and there was an accumulation of old timber in these blocks. Another result of the "precomptage" was that in the area-fellings not enough timber was marked, the Forest Officer fearing, if he took many trees, to reduce too much the volume of the regeneration fellings; the crop in the second and third blocks was thus too dense at the end of the period, and contained a good deal of valueless timber that should not have been left in it.

The forest being communal, a regular sustained annual yield is an absolute necessity, and so, when the working-plan was again revised in 1894, it was determined that the regularisation of the forest should not be obtained by sacrificing any one age-class; that, owing to the uneven state of the crop, periodic blocks, each in a ring fence, should not be maintained; and, finally, that it was not desirable to fix beforehand the date of the regeneration of a crop, and therefore that the final plan was not to be drawn up for a considerable length of time. Cultural requirements of the forest were considered above everything.

The forest was divided into two parts; namely, "R", containing those compartments which required to be regenerated first; and "C", the rest. In "C" improvement fellings were prescribed, that is, thinnings, cleanings, removal of wind-fallen, dead or dying trees, etc., each year. These fellings in "C" were to be made first, and the surplus of the capability over the volume obtained in this way was then to be taken in "R", so that the volume removed from "R" would vary from year to year. The "R" compartments selected were those in which, in 1894, regeneration had already been partly obtained, and so, in practice, the fellings were secondary and definitive only. Of course, as time goes on, parts of "R" will be completely regenerated, and they will then be passed into "C", while parts of "C" will in turn pass into "R", and will then in due course have seeding, secondary, and final fellings made in them.

The capability was calculated in accordance with the orders of July 1883. All trees of 7.9 inches, and upwards, in diameter were enumerated by diameter classes of 1.9 inches. The "old" trees were those of 15.7 inches in diameter, and upwards, while the "medium" were from 7.9 inches to 15.7 inches. The volumes of the "old" and "medium" trees were found to be 1,357,073 cubic feet, and 1,809,289 cubic feet, respectively; but if the proportion had been normal the figures would have been 1,978,976 cubic feet, and, 1,187,386 cubic feet respectively; there was therefore a great preponderance of "medium" trees. It was not considered advisable to make any transfer, nor to fix the annual increment of the "old" trees at more than 1 per cent. The annual increment of the "medium" trees was taken at 2½ per cent., or 45,232 cubic feet, of which half was to be realised. Thus the capability was:—

Volume of old trees	1,357,073 cubic feet.
Increment at 1 per cent. for 20 years	271,415 "
Total	1,628,488 "
which, divided by 40, gives $\frac{1,628,488}{40} = 40,712$ cubic feet.	

Half the annual increment of the "medium" trees, namely, 22,616 cubic feet, was added, which gives a total yield of 63,328 cubic feet.

The poorness of the yield is partly due to the low altitude of the forest, which is not well suited to the production of silver fir, and partly to the numerous hot slopes, which produce nothing but bad silver fir, or else Scotch pine, mostly young.

The rate of growth being somewhat slow the period for the improvement fellings was fixed at 10 years, that is, every
 Improvement fellings. $\frac{77^m}{10} = 77.8$ acres are worked over.

In making thinnings little seems to be done at present except to remove cankered trees. These are so numerous that it is not possible, speaking generally, to make thinnings in the upper storey with a view of improving trees of the future. Trees of all sizes are taken, in order to rid the forest of them, and to realise a sufficient price for them before the cankers cause them to become wind-fallen. In one compartment of dense poles nearly one-tenth of the volume, consisting mostly of diseased trees, was removed in one operation in thinning. In another, with a somewhat open crop of poles, as much had to be taken.

The treatment prescribed for these pole crops of silver fir is to remove first the diseased and badly-shaped trees, and then to thin in the upper storey; but in the Scotch pine the lower storey trees are taken when there is, as often happens, a good growth of silver fir beneath them. The pine acts as a nurse for the silver fir, and there are many flourishing crops of the latter underneath the pine. It is expected that the two species will grow up together, but not that it will be advisable to try and replace the pine by the fir.

Since 1895, 189,009 cubic feet have been taken over the whole forest in improvement fellings, and only 63,638 cubic feet in regeneration fellings; moreover, all these regeneration fellings were made on account of the communal reserve quarter of the capability. The large volume of the former is principally due to the number of cankered trees in the forest. The result of such a large volume being removed in improvement fellings is seen in a compartment of 35 acres, which belongs to the part "R." In 1894 it contained 107 trees and 5,988 cubic feet per acre. Secondary fellings were made in it in 1897, which removed 23,449 cubic feet, or 670 cubic feet per acre, say, one-ninth of the volume. There is excellent reproduction in the compartment, and it would have been desirable to fell more freely; but the number of cankered trees removed from other parts of the forest prevented this being done. It is true that in the near future the cankered trees will have diminished, and the regeneration fellings will be able to be completed in this compartment without any great harm being done by the delay; still, the trees in it have already reached their exploitable size, and should have been felled, especially in order not to do more damage than is possible to the advance growth with which they are surrounded. Moreover, had it been possible to fell more freely, the crowns of more of the younger "old" trees would have been opened out, and they would have had time to put on a good increment before being felled, which they now will do in a much less degree.

It is clear that under the system followed in this forest, which is called the "Wisembach" system, the part "R" is simply a periodic block under regeneration, only it is not in a ring fence, and has not to be regenerated in a fixed period. The regeneration is gradually carried out in it, when the cultural requirements of the rest of the forest have been attended to. It is fairly certain that the treatment will produce what may be called an irregular forest, with the trees in regular groups of varying areas; that the crop will not be exposed to any particular danger from winds, which are not very violent in this district; and that timber will be grown of almost as good quality as is obtained in a regular forest, while the necessity for undertaking artificial reproduction works, or for sacrificing non-exploitable trees will be obviated. It is specially suited to a communal forest, in that the quarter of the annual capability, which is kept unfelled in France until the commune has some special need of money, can always be taken from "R" without upsetting in any way the provisions of the working plan. On the other hand there is a disadvantage in it, and that is that the part "R" cannot be felled over at all in any one year, or even succession of years, unless the volume obtained from the area fellings is less than the capability; so that "R" might fill up with dead or dying trees.

To avoid this possible mishap a modification of the system, which might also be supplied to La Neuveville, has been introduced by M. L'Inspecteur Muller in another forest. This provides for the area fellings taking place over the whole forest, including "R", annually, while the volume fellings are made in "R" alone; which means that no part of "R" can possibly be left unvisited for a number of years; even if no volume fellings were made, it would at least be worked over in improvement fellings. There seems to be special need for applying this modification to La Neuveville, where it is thought that the present part "R" is too large, and where there is a fear that it may not be possible to work over it in regeneration fellings within a reasonable time.

As stated above, the treatment now being applied to this forest will result in the creation of a more or less irregular crop, or rather it should be said that the present partial irregularity will be maintained. It has been objected to it that if the local officer thins too heavily, the crop will become absolutely irregular in character; but the fact that a system may not be well applied by any one particular officer cannot be considered a sound objection to it. Considering the present state of the crop in La Neuveville, and the fact that the property is communal, the system seems specially suited to it. The commune requires a regular sustained yield, and can hardly afford to make the temporary sacrifice which would be necessary in order to convert the forest from its present state into a purely regular one.

There appears to be no advantage in the treatment in force from the point of view of facility of supervision, for the cultural operations necessary give the local officer as much trouble as those in a regular forest. Moreover, as the period of regeneration is longer than it would be in a

regular forest, the damage caused by the fellings is proportionately greater.

The system might be applied to some Himalayan forests, subject always to the doubtful point as to the advantage of irregularity in a forest crop, and always provided that climatic dangers were not serious.

(b) *State Forest of Celles (Vosges).*

Although the Wisembach system has not been applied to this forest, yet the present reaction against the desire to have a regular forest with single-aged crops in each periodic block, whether the natural and other conditions of the locality are suited to it or not, is visible in the way in which it is being treated. As there are forests in France which can be, and are being, satisfactorily treated by what may be strictly called a regular method, and as this is not one of them, I have classed it as irregular.

I visited the second working circle, which is divided into four periodic blocks. The crop is chiefly composed of silver fir, but there is some beech in it. The regeneration of silver fir is good.

The former working-plan was revised in 1890, when it was prescribed that regeneration fellings were to be continued in parts of the first and fourth blocks, and improvement fellings in the rest of them, as well as in the second and third blocks. The capability was calculated on the result of the enumeration in the compartments which were to be regenerated in the sub-period provided for, namely, 1890 to 1908. In those compartments where the regeneration was in a backward state, trees of 7.9 inches in diameter, and upwards, were enumerated, whereas in those compartments where it was advanced only trees of 13.8 inches, and upwards, in diameter were taken into account. It was provided that the volume of trees of 7.9 inches in diameter, in all compartments not enumerated over, which might be removed for any reason whatever, was to be debited against the capability of the forest; this will probably have the effect of delaying the final fellings in the compartments under regeneration.

Except in so far that he is hampered by this "précomptage" and by the fact that he is bound to work over, in improvement fellings, those areas in which poles predominate, every six years, and those containing older stems every nine years, the divisional officer will have a free hand in the management of the forest. The regeneration fellings have to extend over the greatest area possible, by successive fellings, the dead and diseased trees being taken before stems are marked for purely regeneration purposes; and it is specially laid down that no sacrifices are to be made for the purpose of securing regularity in the crop, that is to say, non-exploitable trees are not to be felled except for cultural reasons.

Improvement fellings, which are regulated by area, are, as stated above, frequently repeated and remove as little material as possible at each operation, subject to the provisions that diseased trees are felled, that the crowns of trees of

the future are properly opened out, and their roots are given sufficient space. In all fellings cankered trees are taken as much as possible; the result of which is that windfalls, whose value is 15 to 25 per cent. less than that of standing trees, are becoming much rarer than they used to be. This removal of cankered trees in the improvement fellings sometimes necessitates the cutting of so much timber that the crop is left rather open: in one compartment that I saw, the volume removed from an eighty year old crop has been 129 cubic feet per acre per annum during the last seven years. Such an operation, though most necessary, constitutes an exceptional case, and in other compartments that I visited, where from 30 cubic feet to 100 cubic feet per acre per annum had been taken, the crop did not appear to have been unduly thinned: indeed, it seemed, that sometimes not enough stems had been removed. This is said to be due to the frequent recurrence of the thinnings, which are repeated so quickly that it is somewhat difficult, when marking the trees, to judge the effect of the preceding operation.

As far as it is possible to form an opinion in a somewhat hurried visit, I thought that it would have been better to apply the Wisembach system here, as in La Neuveville; especially as it has been laid down that no sacrifice should be made to obtain a regular crop. Some of the fourth block which is under regeneration looks as if it could not possibly be ready by 1908, being full of a quantity of old timber, in a somewhat dense crop; if no "précomptage" had been prescribed, it might perhaps have been regenerated in time. As this is a State forest in a very well-wooded country the attainment of a regular sustained annual yield can hardly be considered essential, so that "précomptage" might, one would think, have been omitted.

(c) *State Forest of La Joux (Jura).*

This forest, whose area is 6,533 acres, is situated in the inspection of Arbois, in the department of the Jura, at an elevation of about 2,500 feet above sea level. Its surface is undulating, and its soil is generally deep, fresh, and fertile, though in places it is rocky. The underlying rock is oolite. The average annual rainfall is about 17 inches, and there is such heavy snow in winter that, for at least four months, no work can be carried on in the forest. The crop is chiefly composed of silver fir, but there is spruce and some beech. The silver fir seeds freely, from the age of about sixty years, every three or four years, and spruce seeds every year. The exploitable tree is about 30 inches in diameter, and is produced in 150 years, more or less, according to the situation, etc., in which it grows. The whole area is divided into five working circles, varying in area from 592 acres to 1,601 acres.

A working plan was made for this forest in 1866 which provided for its treatment by the regular method, on a Working plans. rotation of 160 years for the first two circles, and 140 for the last three, instead of continuing the former selection working. There were five periodic blocks for each circle, and five periods for each rotation, with lengths of 32 or 28 years, respectively, as the

case might be. Generally speaking, the first blocks were those to be regenerated in the first period, but certain transfers of compartments were made. The capability was calculated on the crops contained in the compartments to be regenerated, trees of 11.8 inches in diameter, and upwards, being enumerated for the purpose, and regeneration fellings were made accordingly. At the same time abnormal fellings called "*coupes de régularisation*" were prescribed in certain other blocks, in order to get rid of the old timber which they contained. In addition to these fellings the four blocks not under regeneration were to be worked over in thinnings during a period of sixteen years, for which purpose each block was divided into eight equal parts. The produce of certain of the compartments not in the blocks under regeneration was debited to the volume of the capability, although it had not been included in the calculation of that volume. Partly, perhaps solely, by reason of this the first block was not regenerated in the proper time, and in 1895 the working plan was revised.

The revision prescribed that the capability should be calculated on the whole volume of each working circle, that is, on the volume of all the trees of 7.9 inches in diameter, and upwards. For this reason all timber of this size wherever felled is debited to the capability; which is of course a perfectly sound procedure, and one which allows the local officer to think only of cultural requirements in marking trees, without forcing him to select comparatively young and vigorous stems for felling in one block, while leaving old and decrepid ones in another. It has, however, the disadvantage that it is liable to cause too much importance to be attached to the improvement fellings, thereby entailing neglect of the regeneration fellings.

There were so many old trees left in the forest that it was found necessary to divide each working circle into two parts, one containing the old timber, and the other the young. In the first of these parts what are called "*coupes jardinatoires*" are made, which are repeated in the same compartment every four years, and therefore cover very considerable areas. In the second part improvement fellings are prescribed, and seven years are occupied in making them over the whole area. The object of the "*coupes jardinatoires*" is to get rid of the worn out, decaying, and diseased trees. The improvement fellings are, as a rule, simply thinnings, which at the outset are made to bear, so far as is necessary, on the cankered and diseased trees, but eventually are made solely for the purpose of opening up trees of the future. They also remove old or big trees which dominate advance growth.

When these marking operations are concluded, and it is known what volume will be removed by them, the balance of the annual capability is taken in regeneration fellings. A felling statement for this last cannot, naturally, be drawn up year by year, as it is for the other fellings; all that can be done is to indicate the order in which the compartments are to be worked over: they are taken, so far as it is possible to do so, adjoining one another, in order that there may be, to a certain extent, a regular sequence of age classes; but this cannot always be done, and is not considered to be essential.

The following statement shows the result of the fellings, during the last two years, for the whole forest:—

Year.	Working circle.	VOLUME OF TIMBER FELLEED, CUBIC FEET.					Total volume.	REMARKS.
		Wind-falls.	Dead or dying trees	FELLINGS.				
				Improvement.	Coupees jardinatoires.	Regeneration.		
1896	North . . .	17,461	10,176	84,369	14,727	178,591	314,343	
	North-East . .	7,304	17,146	19,565	60,001	14,848	119,064	
	East . . .	27,123	46,794	46,652	81,120	58,704	259,982	
	South . . .	12,431	27,511	87,570	95,493	42,484	215,495	
	West . . .	34,645	53,622	87,265	21,512	...	196,894	
	TOTAL .	96,983	167,540	275,426	272,983	291,247	1,105,986	
	Percentage of Total .	9%	15%	25%	25%	26%	100%	
1897	North . . .	33,374	22,440	87,476	80,943	78,542	302,563	
	North-East . .	30,336	40,068	50,683	31,007	...	161,992	
	East . . .	209,009	37,470	26,961	60,566	...	333,926	
	South . . .	87,739	27,617	27,511	18,470	.	161,357	
	West . . .	62,615	60,105	86,661	65,086	...	274,860	
	TOTAL .	422,002	198,707	288,315	256,072	78,542	1,233,818	
	Percentage of Total .	34%	15%	23%	21%	7%	100%	

From this it appears that the rate at which the regeneration fellings can be made depends chiefly on the volume of the windfalls. It is to be expected that, as time goes on, and diseased trees of all kinds are gradually removed, windfalls will be much less numerous, and so the sequence of regeneration fellings will be more symmetrical.

It is found that, at all events in this forest, with a crop of silver fir, aged about 150 years, which has grown up in a more or less dense state, it is almost impossible to obtain natural regeneration: the trees give but a small quantity of poor seed, and a matted layer of roots prevents the seed from germinating properly. Therefore, it is sought to produce a crop whose individuals at any one point will differ in age by 6 years or so, and such a crop, practically, provides trees which have the characteristics of those grown in even-aged forest. Subject to this restriction the ideal forest here is considered to be a regular one, that is to say, it should not have all age-classes represented at every point over its area.

The trees to be felled are, speaking generally, marked in groups. First of all two or three are taken from one place so as to obtain regeneration in it, then their neighbours are gradually removed as advance growth appears.

The spreading of the period of regeneration over so many years naturally causes a certain amount of damage to be done to the advance growth by the fellings, but the trees are branched before being felled, and as they are always removed in a single log the older the advance growth the less the harm done to it.

The volume removed in regeneration fellings naturally varies greatly according to local circumstances. In one compartment which contained a somewhat dense crop of old trees as much as 2,000 cubic feet out of 7,720 cubic feet per acre had been taken in a single operation. In another, where former thinnings had been heavier, 1,220 cubic feet had been taken out of 7,31 cubic feet per acre. In all the cases that I examined the fellings had been very well made, and excellent reproduction had been obtained.

The improvement fellings are commenced at an early age, when the young beech, which are often found mixed with the conifers, begin to interfere with them, and have to be removed. Later on thinnings are made to prevent the young pole crop remaining too dense, but the upper storey is not opened out till the trees have acquired about three-fourths of their final height, always excepting that badly formed or diseased stems, especially the latter, are removed at the time of marking any thinning. Finally, these operations are continued as the crops grow older until they gradually assume the character of seeding fellings. Their general object is to develop as much as possible existing trees, without trying to force the crop to continue to be, or to become, too regular in character. Practically, the local officer is free in carrying them out, and can remove any trees of any size which are diseased, or which interfere with trees of the future. The fact that the volume they realise makes part of the capability causes the system to work easily. At the same time there is a danger that the improvement fellings may be made too freely with the result of making the forest absolutely irregular in character, which is not desired. For the present it is generally sufficient to remove the cankered trees in making thinnings; indeed, in one compartment as many trees had been taken as it was safe to remove, and yet many cankered ones were left. In another compartment, consisting of a crop aged from 30 to 60 years, with old diseased trees scattered through it, a quarter of the total standing volume had been felled, consisting almost entirely of the old trees. Of course as time goes on such heavy fellings will hardly ever be required: and indeed this happens already, for in another compartment, with a crop aged from 60 to 120 years, whose volume had increased from 4,030 cubic feet to 4,930 cubic feet per acre during the years 1883-1895, only 514 cubic feet per acre were taken in thinnings in 1897, and the trees marked appear to have been mostly diseased ones; certainly nothing more should have been felled, since the next thinning was to have been made in 1904. In this particular compartment the Forest Officer had not been afraid to make a

considerable gap, some 15 yards by 5 yards, in order to get rid of diseased trees.

The treatment of this forest is practically that of the Wisembach system. It has not not been found possible to obtain the natural regeneration required by the stereotyped regular method, and so regeneration periods have been somewhat lengthened, and it is sought to obtain regeneration by groups, thereby retaining to a considerable extent the advantage of the production of the long straight boles required by the local market, without being obliged to have recourse to artificial reproduction. The reasons which led to the application of this treatment in the La Neuveville forest were not the same as those which caused it to be introduced here; but the result is practically the same.

(d) *State Forest of the Grande Chartreuse (Isère).*

This large forest is situated round the monastery of the Grande Chartreuse, at all elevations between 1,300 feet and 6,500 feet, the average being about 3,600 feet. All aspects are common in it, and the ground consists almost entirely of steep slopes, many of which are precipitous and inaccessible. The geological character of the area is very varied, but practically everywhere the underlying rock is limestone. There is a good deal of clay in the surface soil, which is generally covered with a more or less thick layer of humus, and is, especially in the lower and central parts, fairly fertile. In the upper part, at the foot of the precipices, and along the numerous watercourses, it is shallow and rocky, being quite unsuited to forest vegetation. The total area of the forest is 16,306 acres, of which 2,775 acres are bare, and 229 acres are covered with coppice, while the rest is covered with a mixed crop of spruce, silver fir, and deciduous trees; the latter, which are mostly beech, are worth much less than the conifers, and constitute about 40 per cent. of the crop. The three species of spruce, silver fir, and beech are found in very varying proportions in each compartment, being as 4 : 4 : 3, 4 : 3 : 3, 3 : 3 : 3, 3 : 5 : 2, 4 : 1 : 5, and so on.

The forest is well served with roads and paths. Of the former there are nearly 24 miles, which are metalled and graded for cart traffic. In spite of the roads the difficulty of extracting logs is great, and on account of this, of the remoteness of the forest from villages, and consequent difficulty of procuring labour, the prices obtained for timber are low, first class spruce or silver fir not fetching more than 3½d per cubic foot in the forest. Indeed in the upper parts of the forest, near the monastery, it is sometimes difficult to find a purchaser for fine young beech poles, so that cultural works, such as cleanings of inferior species, often have been neglected on account of their high cost. In these parts too there is much difficulty in getting rid of the branches and *débris* resulting from fellings, whereby most of them have to be burnt in the forest, a most objectionable practice. The winter is long and severe, with a heavy snowfall, which necessitates the exploitations being made in the few months when the forest is open, say during six or seven months. Finally, the trade conditions of the country require that spruce and silver fir should be extracted in very

long logs, practically the whole length of the bole, and so, the logs being difficult, and costly, to remove on such steep slopes, an unfavourable influence on prices is produced. This practice of removing timber in long logs causes considerable damage to be done to the standing crop.

All these facts, as well as the rare occasions on which silver fir seeds, that is, not more than once in seven or eight years, render the management of the forest difficult, and reduce both the annual revenue and the yield.

Previous to 1863 the forest was selection worked, with some unsystematic attempts at regularisation, and with some thinnings by volume, which were commenced in 1854. In 1863 and the following years a working plan was made, which divided the area containing conifers into 18 working circles, of which 9, with an area of 7,308.9 acres, were to be treated by the regular method, with rotations of from 120, to 180 years in length, according to circumstances. The other nine circles, which were at elevations of 4,600 feet and above, or else consisted of precipitous ground, were to be selection worked. Of these last one, "B", was left as an ornamental forest round the monastery, and another, "I", was a protection zone; neither of them was to be felled over except under special circumstances.

Each of the first nine working circles was divided into four periodic blocks and, generally speaking, each of them was to have its first block regenerated in the first period, while the rest of the circle was to be worked over, by area, in improvement fellings, consisting of the removal of old trees, or of thinnings, or of both. The selection worked circles, were each, except "B" and "I", divided into 20 compartments, of approximately equal area, which were to be felled over in 20 years; dead, dying, and the older trees being removed from them.

It was found impossible to get sufficiently good natural reproduction in the nine circles under conversion, to enable them to be treated by the regular method, and so in 1887 a revision of the working plan was made, and it was decided to work them all by the selection method, the capability being calculated according to the orders of July 1883. At the same time certain of the original selection-worked circles were placed outside the provisions of the working plan, and, forming "zones de protection", were only to be felled over under special circumstances, while yet another circle, containing nothing but a young crop, was to be worked over in improvement fellings on a 20 years' rotation. The remaining four selection worked circles were to continue to be treated by that method, but were to have their yield calculated according to the orders of 1883 and not, as was formerly done, "per pied d'arbre."

The annual capability of the forest was fixed in 1859 at 221,534 cubic feet, the result of the experience of past working. This was raised by the working plan of 1863 to 317,840 cubic feet, and again in 1887 to 394,888 cubic feet.

As an example I give the figures of the calculation of the capability of the third working circle according to the plan of 1887. From experiments it appeared that the exploitable tree of 70·8 inches in circumference was 180 years old, and the rotation was therefore fixed at 180 years. The long rotation was the more necessary on account of the infrequency of good seed years. The rotation was divided into three periods of 60 years, and each period into three sub-periods of 20 years, during each of which sub-periods the whole circle was to be felled over once. The length of the sub-period was justified because (a) a shorter one would not have allowed the great damage caused by the fellings to be repaired by nature; (b) a shorter one would have made the size of the coupes too big for economical working in such a difficult country; and (c) in 20 years a tree puts on 7·9 inches of circumference as a rule, and passes from one age class to another.

The classes of "old" and "medium" trees, which were of 47·2 inches in circumference and upwards, and from 23·6 inches to 47·2 inches in circumference, respectively, were enumerated, and then cubed from the old tariff, with the result that the "old" were found to contain 4,745,394 cubic feet against 2,302,825 cubic feet of the "medium." The "old" trees were too numerous, and as seedlings and poles were also scarce, the whole of the volume of the 47·2-inch class was transferred to the "medium" trees. After this the old trees contained only 3,902,410 cubic feet. No account of the increment was taken in the calculation of the capability, because it was thought better to have a reserve to cover possible errors in the calculation, or in the enumeration, which seems perhaps to have been rather too cautious under the circumstances. The annual capability was therefore $\frac{3,902,410}{60}$ cubic feet = 65,040 cubic feet. The plan prescribes the order in which the compartments are to be felled over, and, as an indication, the amount of timber which is expected to be realised from each compartment during the first rotation.

In the upper part of the forest the difficulties of treatment are not unlike those that we find in some of the Himalayan forests. It is hard to obtain reproduction of the more valuable species; undergrowth springs up easily, and is sufficiently dense to interfere with the establishment of advance growth; high prices cannot be obtained; exploitation is difficult and does considerable damage to the standing crop; the necessary improvement works are costly and for that reason often have to be left undone; supervision is difficult owing to the steep nature of the ground; and, finally, all operations have to be conducted in the most cautious way for fear of uncovering the soil too much. These forests are more easy to manage than ours from the point of view of the absence of grazing rights, and fear of fires. Also, as might be expected, the establishment is larger than ours, there being one officer and fifteen subordinates to about 12,000 acres. Moreover much more information about the standing crop is available than we ever have, and the yield figures are known for many years past; this enables the capability to be fixed with far greater accuracy than we can do at present, a matter of the highest importance.

The present treatment seems to be the best that could be devised under the circumstances. The divisional officer has a very free hand,

being really only bound by the volume he must take annually. All windfalls, dead, dying, and diseased trees are removed; the necessary cultural operations such as thinnings are undertaken wherever it is possible to find a purchaser for the produce, and eventually the balance of the capability is removed in selection fellings. These last appear to be made in groups of 3 or 4 trees as far as is possible, but in many compartments the nature of the growth does not allow this, and the trees are taken here and there either for the purpose of uncovering promising advance growth, or for obtaining regeneration. Their great characteristic is the extreme caution displayed in not opening out the forest too much. The only point on which the management might be unfavourably criticised is the not infrequent neglect to perform cultural operations, such as the removal of beech which interferes with established conifers, or prevents their establishing themselves; but, as all such operations are carried on at a considerable loss, it is evident that considerations over which forest officers have no control must influence their being made.

The result of the system followed is to produce an irregular forest, with a good and advantageous mixture of beech. Results of system. The beech will very possibly form too large a part of the crop, and the irregularity of the forest will not allow the production of timber of the finest quality; but the soil is well covered, windfalls form only 5 per cent. of the out-turn in volume, and the yield averages more than 29 cubic feet per acre per annum, which are most satisfactory results for a forest where the natural conditions for the production of timber are so extremely unfavourable.

In the lower and more accessible parts the natural reproduction is better, all timber can easily be disposed of, and the climate is less severe. It is thought by some forest officers that in these parts the crop might have been regularised with advantage, and put under the regular treatment as it is now understood. There seems to be a good deal in favour of this contention, especially as not a few compartments are already under fairly even-aged crops; but it was decided to irregularise the whole forest, including the lower parts. This, however, will take a long time to accomplish, because trees can only be taken here and there, and, as a rule, with caution: if they were felled in groups in the old pole crops, snow would inevitably play havoc with what remained. For this reason such crops are felled over in what are simply ordinary thinnings, made chiefly with a view to opening up stems of the future. For instance, one compartment that I saw, which contained a crop aged about 60 years old with 175 stems and 6,500 cubic feet to the acre, had had 790 cubic feet per acre removed in one operation. It is clear that such fellings as this, although combined with the annual removal of dead, dying, and wind-fallen trees, which produce but a small yield, will take many years to create an irregular forest, indeed the crop must pass through a regular state first. At the same time heavy thinnings are made when the local conditions are in favour of them and promise to allow the creation of an irregular crop with less loss of time. For example, in another compartment, I saw, which had an age of about 100 years, contained 185 stems and 8,300 cubic feet to the acre, a single operation had removed more than 2,000 cubic feet of timber.

The comparison between this forest, and those of the Vosges and Jura described above, shows how one can be forced by local circumstances to abstain from applying the best theoretical treatment. It is not that it is thought the regular method, or the Wisembach system, cannot produce a finer and probably larger out-turn than the one followed here, but that it is impossible to apply them owing to the climate, the nature of the soil, the difficulty of obtaining natural reproduction, the poorness of the market for certain kinds of timber, and the difficulties of supervision. Now, while it is perhaps doubtful whether it would not have been possible to alter the system for the lower parts of the forest, and so get better results, it is clear that, in France, the necessity that exists for not adhering blindly to any particular method or system is recognised. The treatment, whether classic or not, that seems best to meet the requirements of local conditions, is applied; in some cases the Wisembach system, in some the regular method, and in others the selection method.

(B) REGULAR FORESTS.

The treatment of the forests described above will produce in them more or less irregular crops, but there are still many resinous forests in France treated on the basis of the old regular system: such are the five forests described below.

(c) *Communal forest of Crèdes (Vosges).*

The area of this forest is 458 acres, and it is divided into four periodic blocks, approximately equal in area. The underlying rock is either red or Vosges sandstone, and the surface soil is generally good, and well suited to the production of silver fir, of which the crop is almost entirely composed, though beech and spruce are found. The reproduction of silver fir is good.

In 1871 a working plan was made, which fixed the rotation at 120 years, and divided it into four periods of 30 years each, with four corresponding periodic blocks. Former treatment. The treatment prescribed was the usual one for forests which were regular, or were to be regularised; that is the "réensemencement naturel avec éclaircies." This method was the easier to apply in that the distribution of the crop in 1871 lent itself to the division into the required periodic blocks; for a strip along the lower edge had been felled over and planted up, some 40 years previously, and this was made into the third block. Also, part of the forest had been felled over, and was covered with a good advance growth which had some old trees standing over it; this was made into the fourth block. Of the rest of the area, that which contained the oldest crop was, of course, taken for the first block.

In 1889, that is after 18 years, the working-plan was revised for the remainder of the period, namely, 12 years. The Revision of 1889. capability was calculated on the growing stock in the first block only, trees of 11·8 inches, and upwards, in diameter being enumerated instead of trees of 7·9 inches, and upwards, because it was near the end of the period. The capability was thus fixed at 35,951 cubic feet per annum; in addition to which, and apart from the annual yield of

the forest, 53,150 cubic feet were to be felled in the fourth block, being the balance of the reserve quarter not previously required by the commune. The second block was not to be touched, except that windfalls and dying trees were to be taken yearly, and the volume so taken was to be debited to the capability of the forest; a procedure which can be justified by the desire to give a regular sustained yield to the commune but which, it would seem, might have been omitted with advantage: certainly, experience has shown that the volume removed from the second block is not large, but if it were it would upset the regeneration arrangements in the first block. In the third block thinnings were prescribed by area, the whole block having to be worked over once in six years.

These prescriptions are now being carried out. In the first block there is a certain irregularity in the underwood, for, very rightly, groups of young poles which existed before the regeneration began have been left standing; they will practically form a single-age crop with the advance growth now being created, though the extreme limits will differ in age by about 40 years, instead of by 30 years, as they should do at the end of the first period in 1901. Here and there small patches are planted; these are very insignificant, and are in places where, for some special reason, such as the stacking of timber on them, natural regeneration could not be obtained. At the time of the principal fellings cleanings, and even thinnings, are made, when necessary, in the underwood. In the second block nothing is done except to remove the windfalls and dying trees. In the third block improvement fellings are carried on every year; which consist chiefly in the removal of dead, and actually dying trees, and are not sufficiently intense. For instance, in one compartment, only 190 cubic feet per acre were taken in thinnings, and since the operation was performed it has been necessary to remove twice as much volume in dead timber, most of which came from cankered trees. If these cankered trees had been felled at the time of the thinning, there would probably have been very little dead wood to be taken since; this fact has been found out by experience, and is now being acted on, as many cankered trees as possible being marked in thinnings, while the crowns of trees of the future are also being opened up. In the fourth block the few old trees remaining are being removed in accordance with the prescription of the revision of 1889, and the young growth is being thinned where necessary.

This is an excellent example of conversion of a more or less irregular forest into a regular one, which can be treated by the stereotyped regular method. The conversion has been helped by the chance that the third and fourth blocks were almost, so to speak, ready made. By the end of the first period the whole forest will practically be in a normal condition, while the only sacrifice that will have been made to attain this will be that trees in the second block will have been left standing for some years beyond their exploitable age. The forest being a communal one it was necessary that there should be a sustained regular annual yield; and this will have been obtained, except perhaps in the fourth period, when the volume of timber available may be rather small.

(f) State Forest of the Val de Senones (Vosges).

The area of the whole forest is 10,329 acres, and it is divided into five working circles, of which I visited the first, whose area is about 1,374 acres. It is at an elevation of about 2,000 feet, has a general northerly aspect, with underlying rock of the Vosges sandstone, and the soil, which is generally fairly fertile and moist, is well suited to the silver fir which composes most of the crop. The growth of the silver fir is somewhat slow and the rotation has been fixed at 150 years, though it might have been less in the first working circle. The crop is characterised by the absence of "medium" trees—a state of affairs which was noticed in 1806. This is partly due to the former selection fellings, which, having been only moderately intense, produced here, as is always the case, an excess of both large and small trees, to the exclusion of those of intermediate size. There were certain other reasons which helped to produce this result, such as the utilisation of "medium" trees for making the rafts on which the big timber used to be floated away; but the method of working was primarily responsible for it. Another characteristic of the circle is the remarkable ease with which natural reproduction can be obtained; the question of regenerating the forest is thus quite an accessory one. No plantations are made except on very hot slopes, or in marshy places.

The forest was worked, up to 1866, in a haphazard kind of way, a sort of selection method being practised, and, as stated above, when a working plan was made for it in that year it was in a more or less regular state, containing chiefly large trees and poles. It was decided to completely regularise it, and to that end it was divided into five periodic blocks, each in a ring fence, and each of which was to be regenerated in its corresponding period of 30 years. The first block was, therefore, to be regenerated in the first period, during which time the rest of the forest was to be worked over in selection fellings, except the second block, which was to be left alone to accumulate material. This was a mistake since no accumulation of material was necessary, and since many of the trees in the second block were diseased, while most of them were exploitable. The regeneration of the first block was started, but little was done in the rest of the forest until a good many years had elapsed, when it was found that the third and fifth blocks were becoming crowded with old timber, and selection fellings were begun in them with the object of getting rid of it. Then it seems as if there was a fear of felling too much in the forest, and so the volume of the selection-felled timber was debited to the capability of the forest which, according to the original plan, was to have been taken from the first block only. The result was that at the end of the first period the first block was not entirely regenerated but had a considerable quantity of old timber standing in it, especially in one compartment; and this result was the more certain since, towards the end of the period, regeneration fellings were made in the fifth block, which it was thought had urgent need of them in certain parts.

In 1896 the working-plan was revised, and the capability calculated according to the orders contained in the note of the 17th July 1883. For the calculation of the capa-

Revision of 1896.

bility, all trees of 7.9 inches in diameter, and upwards, were enumerated, with the result that the old timber was found to have a volume of 5,037,808 cubic feet, while the "medium" trees had only 1,170,324 cubic feet. The report says :—

"If the proportion of 5 to 3 which ought to exist between the 'old' and 'medium' timber be established, it appears that the old is too great by 1,157,726 cubic feet. Therefore all timber 15.7 inches in diameter will be transferred to the 'medium' size, whereby the volume of the 'old' will be reduced to 4,363,562 cubic feet, to which must be added the annual increment at 1 per cent. for 4 years = 1,090,890 cubic feet. The total is thus 5,454,452 cubic feet; and the annual capability of the 'old' timber will be 109,089 cubic feet. If the annual increment of the 'medium' timber be 2½ per cent., this will amount, in 50 years, to 2,305,712 cubic feet, of which it may be assumed that half, say, 1,152,856 cubic feet will be realised at intermediate fellings, that is, 23,057 cubic feet a year. Thus, in all, there will be a capability of 132,146 cubic feet a year."

This capability was to be taken first in wind-falls and dead trees, then in improvement fellings of all kinds, which at present consist almost entirely in the removal of old and diseased trees, and, finally, the balance in regeneration fellings from the second periodic block. Of course the volume of all trees of 7.9 inches, and above, in diameter, which were felled, was to be debited to the capability. It was prescribed that the improvement fellings were to cover the whole area of the forest, except the second block, once in ten years. In the second block the regeneration fellings were to pass quickly in six or eight years over the whole area, removing all the oldest trees, and later on taking the form of ordinary regeneration fellings.

As a matter of fact it was not possible first of all to make any fellings in the second block, so much of the old bad material had to be removed from the others; but the improvement fellings have become less intense, and regeneration fellings are now being made in it. It is thought that there will be no difficulty about regenerating the whole of the second block during the second period, since, owing to the fact that the cankered trees have caused so many wind-falls, its crop is now as if a seeding felling had been made in it: but even so, the forest will, at the end of the first revolution, be far from presenting a normal series of age classes by blocks. A considerable portion of the fifth block, the age of whose crop should be from thirty to sixty years, is covered with underwood of from one to fifty years in age, while there are still some big trees left in it. The first block is not yet completely regenerated; while the third block, where the regeneration fellings should take place in the third period, has already much advance growth in it.

However, the main object of the treatment is to secure a regular forest, that is to say, trees of more or less the same age, grown in a more or less dense crop; and this object will be attained. Nevertheless, at all events for many years to come, the annual yield will vary greatly from period to period. It is true that in a State forest, especially in a well-wooded country like the Vosges, a regular sustained annual yield is not absolutely necessary; but, looking at the forest now, it would seem that had this been recognised, years ago, and no "précomptage" of the selection fellings been made, the forest would have been in a much better state to-day, while less

increment and revenue would have been sacrificed by leaving the old trees so long unfelled. It is, of course, open to argument, and the point has never been decided, whether it was advisable to convert a forest, such as this was, into a regular one, rather than to try to make it into one of all-age classes mixed over the whole area. Assuming that conversion was desirable it would seem as if, at one time, it had been hoped to achieve the desired result without making any sacrifices; which was impossible, and only led to greater losses.

(g) *Communal Forest of Pontarlier (Doubs).*

This is another example of what may be called a regular high forest treatment, for, although the regeneration periods are longer than they should be according to the text book theory of the method, and the periodic blocks are not in ring fences, yet the trees are grown from natural reproduction, in a dense and practically even-aged crop, and so, being treated by successive regeneration fellings, followed by thinnings, are given long, straight, clean boles.

The present area of the first working circle is 599 acres, and it is situated on a gently undulating plateau, about 2,950 feet above sea level. The soil is fresh, fertile and deep, with jurassic limestone underlying it. The rainfall here is heavy, being about 50 inches a year, and during four or five months the forest is under snow. The winds are violent, but not exceptionally so for a mountainous country. The crop consists of silver fir and spruce, in the proportion of about 9 to 6. From time to time, for many years past, patches of communal grazing-ground have been added to the forest by being planted up. This planting is almost invariably done with spruce, so that a good deal of the spruce found in the forest has been artificially introduced. Natural reproduction of silver fir is excellent, and abundant.

In 1888 the working plan was revised by M. L'Inspecteur Cardot. As the original plan of 1858 was made by M. Cardot's father, as both officers were of opinion that, at all events in this locality, it was better to raise a regular than an irregular crop, and, finally, as either one or the other of them has been chiefly responsible for the management of the forest during the greater part of the last thirty years, it is well able to show the result of the method of treatment followed.

Previous to 1858 the forest was selection worked, but the plan of that year prescribed a regular high forest treatment with a rotation of one hundred and fifty years, divided into five equal periods, corresponding to which five periodic blocks, of approximately equal area, were made. Each block was to be regenerated in its corresponding period, and each was sub-divided into three compartments. For the first sub-period of fifteen years the capability was calculated from the volume of all trees of 31.4 inches in circumference, and upwards, in the first block, with their annual increment for fifteen years, as well as from the old scattered trees which were standing over advance growth in two compartments each of the fourth and fifth blocks. In 1873 all the old trees had been removed from these last two blocks, and the capability was re-calculated for fifteen years from

the then standing volume in the first block, to which was added half of its past average annual increment. During the first sub-period 29,417 cubic feet were cut annually, but this figure was raised during the second sub-period to 33,762 cubic feet. At the end of the period all the first block had been satisfactorily regenerated by successive regeneration fellings, except about a quarter of its area, in which some secondary and final fellings still had to be made.

In the meantime improvement fellings had been made in the blocks which were not under regeneration. These consisted in thinnings which were to remove "the trees which had no future and interfered by their cover with better stems in the young crop", while in the older compartments "the dead, dominated and dying trees" were to be taken, as were those which were "in excess of the numbers required for the available area, or which were altogether too old to be able to form part of the main crop." One of the objects of these thinnings was to obtain regularity in the crop, and this has been successful. There was no "précomptage" of the produce of the improvement fellings, which amounted to 474,959 cubic feet in the first period of 30 years, that is, to about half the volume of the principal fellings.

The revision of 1888 ordered that (a) the regeneration of the first block was to be completed as soon as possible during the second period, and that improvement fellings were also to be carried on in it; (b) regeneration fellings were to be made in the second block; and (c) the remaining blocks were to be worked over in improvement fellings. The capability was calculated in the same way as was followed for that of the first period, but on the volume of the standing crop of trees of 31.4 inches in circumference, and upwards, in the second block, together with their annual increment, and plus the volume of the remaining exploitable trees in the first block. The produce of the improvement fellings was not to be debited to the capability.

The chief point about the regeneration fellings is that they are made very cautiously, and are so arranged that they will take something like 50 years, that is one-third of the revolution, to complete the reproduction in any given compartment. Trees which have no future, and these are as a rule the biggest, are removed first; but they are not taken in groups, so that the smaller ones which are opened out by their removal put on much increment during the time they remain in the forest before being felled. Practically this is what has been done in the first block, and the result is eminently satisfactory, for the crop produced is, to all intents and purposes, even aged.

As M. Emile Cardot says, it seems that 30 years is too short a time for the complete removal of an old crop, and that it is best to make the regeneration encroach on the periods preceding and succeeding that in which it is supposed to be completed. This is done by starting the regeneration in strong thinnings before the period begins, and by completing it after the period is over by improvement fellings. The advantages of this procedure are that (a) apart from the question of thinnings,

and of the conversion of irregular into regular high forest, it is never necessary either to fell trees which have not attained their exploitable size, or to leave trees standing after they have attained that size; (b) natural reproduction is easily assured, any quantity of good seed being obtained from the youngest trees, which are the last felled, and little undergrowth being produced to interfere with the advance growth; (c) not much harm is done to the advance growth by the fellings; (d) the timber produced has the qualities of that grown in a regular high forest and yet (e) the irregularity of the crop in its younger stages greatly simplifies the operation of marking thinnings—an operation which is difficult to do properly in any case, but whose difficulty increases the more even-aged the crop. These advantages are obtained without sacrificing the regularity of the crop, and, as an inspection of the forest shows, the results are magnificent. Speaking very generally it may be said that about one-sixth of the standing volume is removed in a seeding felling.

Improvement fellings, regulated by area, are made in those parts of the forest not under regeneration, being repeated Improvement fellings. in each compartment every ten years. They comprise "coupes jardinatoires," cleanings and thinnings. In the "coupes jardinatoires", which are applied to the older crops, dying trees are taken, as well as any trees that, being too old to survive naturally until the time fixed for the regeneration of the compartment in which they stand, interfere with the advance growth in it. In the thinnings, subject to the general principles that they should be light and often repeated, and that the soil is not to be too much uncovered, the following trees are marked, but not in the order given, nor indeed in any specially laid down sequence, for the requirements of the crop vary every few yards: (a) the dead trees; (b) dominated trees which cannot survive for ten years; (c) superabundant trees, that is to say, those which have no future, which are not required to cause the fall of the lower branches of the best stems, and which therefore are injurious to the forest as absorbing water and nutriment to the detriment of other stems; (d) trees which are so much older than the majority of their neighbours, that they can never form with them a homogeneous crop: but these are not taken until the latest possible moment, i.e., until they actively begin to impede the growth of the others; (e) diseased trees; (f) trees in the upper storey whose removal is necessary to give sufficient space to the crowns of their neighbours; (g) sound trees of considerable size whose removal gives growing space to several somewhat smaller but healthy neighbours; (h) badly shaped trees.

The volume removed in thinnings naturally varies greatly, according to the nature of the crop dealt with. In one case I saw a crop, aged about thirty years, which produced 10,574 cubic feet to the acre and had had 86 cubic feet per acre taken from it, on an average, for the last ten years. In another crop, whose age was about 100 years, and which had 160 stems of 13.4 inches, and upwards, in circumference, and a volume of 11,286 cubic feet per acre, the astonishing quantity of 86 cubic feet per acre had been taken annually for the past 30 years and probably not much less for the 30 preceding years. It is, however, impossible to describe these operations properly by means of figures.

Since 1858 the average annual yield of this forest has more than doubled, while the volume of the material in the forest has gone on increasing. Of the total yield since 1858, about two-fifths came from the area felling, and these represent about one-third of the total money value of the yield. Yield figures of this kind, however, prove practically nothing, and one cannot form an opinion from them of the success of the method applied. The treatment seems to be extremely well suited to the production of the straight fine grain timber in local demand, and if it be said that, by reason of the regularity of the crop, its average annual yield is less than it might be, the reply is that this has never yet been proved, even in a general way, while in the opinion of M. Emile Cardot it is certainly not the case for this locality. In this forest one sees the Nancy system of managing a regular forest rationally, and successfully applied. The amount of attention that has to be given to each compartment is great, but not, I think, so great as would have to be given were the forest treated by the selection system worked according to modern ideas.

This forest also shows how an irregular crop, which has been selection-worked, may be converted into a regular one, within the short space of little more than one period. All the periodic blocks may now be held to be in a normal state, and each one contains a crop practically representative of what it should be theoretically. The fifth block was created partly by chance, for it consisted chiefly of plantations in 1858, but the rest of the forest, save two compartments in the third block, where M. Lorentz made a final felling in 1822, had only been selection-worked up till then.

It is very noticeable how little attention has to be paid to the question of winds in this forest: the periodic blocks are not in ring fences, and no special precautions are taken to prevent wind-falls, other than felling against the general direction of the prevailing winds. Nevertheless winds do little harm to the crop.

This forest has yielded a net return of over £2 an acre per annum during the last thirty years, and the commune is wisely including within its boundaries some of the communal pasture lands which are suitable for tree planting. In these plantations practically nothing but spruce is put out. The plants are taken from the nurseries at the age of four or five years, and about 3,600 are planted on each acre, at a cost of about 32s. The holes for the plants are generally made in the autumn, while the plants are put out in the spring. This gives better results than when the holes are made in the spring, though the latter system costs about 10s. an acre less than the former. The planting is very well done, and hardly any repairs are found to be necessary.

(h) *Communal Forest of Gilley (Doubs).*

Another example of a very similar forest, treated in a similar manner, and equally successfully, is the communal forest of Gilley. Its elevation is about 2,800 feet above sea level; its area 784.7 acres; its soil, which has the upper oolite underlying it, is fertile, with a good covering of

vegetable mould into which the roots can easily penetrate. The species now are, spruce 60 per cent., silver fir 30 per cent., and beech 10 per cent.; the present treatment is more favorable however to the silver fir than to the spruce.

Previous to 1857 the fellings made were "coupes jardinatoires"

whose object was to regularise the crop. In 1857 the working plan prescribed treatment by the regular method, and the forest was divided into seven periodic blocks, of approximately equal area, each of which was to be regenerated in a corresponding period of 20 years, the rotation being 140 years. The blocks not under regeneration were to have improvement fellings made in them, each compartment being worked over once in four years. These fellings were, among other things, to remove the old timber standing over, and impeding the growth of young, or middle-aged crops. Thinnings appear not to have been sufficiently strong in certain compartments of the third block, for, in parts of it, the crop is too dense, and the crowns of the trees too small. I saw a compartment which contained some 200 stems of all sizes, cubing 8,575 cubic feet per acre, the age of the crop being about 120 years, and the total height of the trees from 115 feet to 130 feet. A comparison of this with parts of the second block, which are in a better condition, shows conclusively that it has not been sufficiently thinned in the past.

In any case the regularisation was well effected and in 1890, after the

Revision of 1890. lapse of rather more than a period and a half, almost all the old scattered trees had been got rid of, the crop appeared normal over almost the whole area, and there was every chance of a regular sustained annual yield being obtained. The "medium" trees, which had been scarce, were well represented, and about two-sevenths of the forest contained a pole crop of various sizes. At this time the first block had been successfully regenerated, as had a considerable portion of the second block; but, when the revision was made, it was found that the compartments which had to be worked over in regeneration fellings during the latter part of the second period, and during the third period, contained a good deal of comparatively young timber in full vigour, which would have had to be felled if the original small blocks and short regeneration periods had been maintained; so the blocks were reduced to four in number, and the periods were lengthened to 35 years, which resulted in giving a much freer hand to the divisional officer in marking the fellings. In fact the system was modified until it was practically the same as that described above for the forest of Pontarlier, and the same results will be attained, except that the regeneration periods being somewhat shorter the advantage obtained from having some irregularity in the earlier stages of the growth of the crop will be less; but the difference is very small. Most of the big timber in the remaining blocks having been worked out in the first 30 years, the improvement fellings now pass only once in nine years, instead of every four years, over each of the compartments not under regeneration.

Although this forest is not protected from the wind in any particular way, and the winds are somewhat violent, yet the question of wind-falls is of slight importance. Few

Wind-falls.

trees are blown down where the crop is dense, and even when it has been opened out for reproduction the wind-falls are rare. If they do occur in the areas of regeneration, since only the best trees have been left standing, few are broken in their fall, and as these have no side branches they do not do much damage to the advance growth beneath them.

The way in which the blocks are scattered is very noticeable in these Jura forests, and yet, although the crops are not irregular, but little damage is done to them by the wind. For example, this forest is composed of four distinct patches, separated the one from the other by several hundred yards width of cultivated lands. The first patch contains, in a ring fence, three compartments of the first periodic block, whose combined area is 116.1 acres, one compartment, 86.4 acres in area, of the second block, two compartments, 60.2 acres in area, of the third block, and seven compartments, 211.8 acres in area, of the fourth block. The next patch contains only 5.3 acres of the fourth block. The next contains 86.4 acres, being three compartments of the third block. Finally, the fourth patch has three compartments, 70.6 acres in area, of the first block, two compartments, 106.9 acres in area, of the second block, and three compartments, 40.1 acres in area, of the third block.

(i) *State Forest of La Fuvelle (Doubs).*

This forest, situated near Pontarlier, has been treated in much the same way as the Communal Forest of Pontarlier and Gilley, which it resembles in most respects. Originally the selection method was applied to it, but for some 30 years previous to 1858 fellings were made with the object of regularising it, and these have since been continued with the most satisfactory results. The altitude of the forest is about 2,900 feet, its aspect is general, and its soil, usually moist and fertile, but sandy in places, comes from the upper jurassic formation. The crop is composed of about two-thirds of spruce, and one third of silver fir. The area is 368.6 acres, and this was divided in 1857 into seven periodic blocks which were to be regenerated successively in periods of 20 years. During the first period the first block was regenerated, in spite of the fact that some old trees were removed from the sixth and seventh blocks whose volume was debited to the capability of the forests. This seems to show that the capability, which was calculated on the trees in the first block only, had been fixed at too high a figure.

During the second period, *viz.*, from 1878 to 1898, the working plan provided for the regeneration of the second block; for improvement fellings, consisting chiefly of the removal of dead and dying trees, in the third and fifth blocks; and for thinnings in the sixth and seventh blocks. Up till 1888 seeding fellings had been carried out over the whole of the second block, and secondary fellings over part of it; but certain difficulties were experienced owing to the shortness of the regeneration period, and it was thought that the seedlings which had been obtained ought not to be uncovered by the end of the second period. Furthermore, there had been excessive windfalls in the third block during the cyclone which occurred in 1880, so that, on the whole, it was considered better to revise the working plan.

This was done in 1888, and the revision prescribed that, during the last half of the second period, seeding fellings were to be made, by volume, over the whole of the third periodic block. After these were completed the capability was to be taken in the second and third blocks, the former, for choice, in secondary and final fellings. At the same time it was laid down that the regeneration of the second block was to be completed half way through the period, that is to say, the period of regeneration was to be increased from 20 to 30 years. It is probable that it will be even longer. One would have thought it would have been better to recast the periodic blocks, as was done in Gilley, for the result would have been the same, and to do so would have simplified matters; but it was considered better to leave them untouched, and the point is of slight importance.

In the remaining blocks improvement fellings by area were prescribed; these were (a) "coupes jardinatoires" in the older parts, which consist in the removal of dead or dying trees, with thinnings, if necessary, and (b) for the younger parts, "coupes d'amélioration" or thinnings, combined with fellings of trees, too old for the crop, which interfered with younger stems, as well as the removal of dead and dying trees. The "coupes jardinatoires" pass generally once in five years, and the others once in ten years. The system of making thinnings is practically the same as in the communal forest of Pontarlier, as is the cultural treatment generally.

The capability was calculated on the trees contained in the second and third periodic blocks, from the enumeration of stems of 23.6 inches in circumference, and upwards, measured at a height of 51.1 inches above the ground; each size class contained trees 7.9 inches in circumference greater than those of the one below it. The tariff of the old working-plan was used for calculating volumes, and 0.09 of the stem volume was added on account of the volume of the crowns. It was thought safer to take no account of the increment of the trees remaining in the second block, because they had reached their exploitable size, and their increment was therefore feeble; but the average annual increment, calculated from the past growth, was added to the volume of the trees in the third block, being taken for 19 years, the length of time to elapse before the middle of the third period. The figures of the calculation are:

2nd block, stems	2,937,	volume	256,073	cubic feet.
3rd block, stems	4,968,	volume	484,958	"
Add increment of 3rd block	.	.	76,776	"
Total volume	.	.	817,802	"

The capability is $\frac{817802}{29} = 28,200$ cubic feet annually. This means a reduction of 1,180 cubic feet per annum to the former capability, a result which is due to the premature extractions made in the 3rd block on account of the wind-falls of 1880.

The following statistics are interesting:—

During the first 20 years 8,601 trees of 590,300 cubic feet were obtained from the volume fellings, and 7,873 trees of 383,773 cubic feet from the area fellings, which realised respectively £10,931 and £6,756.

During the next 20 years the volume and area fellings produced 563,954 cubic feet and 298,946 cubic feet respectively, which were sold for £11,067 and £4,976. Against this revenue must be set off £200 spent on roads, £105 spent on walls and £22 spent on artificial reproduction, which last sum does not include the cost of re-afforesting various old pasture lands, not included in the area given for the forests, and on which several hundred thousand plants have been put out. From these figures it appears that, apart from establishment charges, there has been, during the past 40 years, an annual net revenue per acre of nearly 46s., and during the same period an annual yield per acre of over 120 cubic feet. I may mention that the price of first quality timber, standing in the forest, is about 5½d. per cubic foot for silver fir, and about 6d. per cubic foot for spruce.

(C) MISCELLANEOUS FORESTS.

(j) *An experiment in the Vosges : State Forest of Côte de Repp.*

The actual area of this forest is 1,274 acres, and it is situated at elevations of 1,000 feet in the lowest part to 2,000 in the highest. The underlying rock is the Vosges sandstone, which has produced soil which is generally moist and fertile, but is poor and dry on the south slopes. The ground is very broken and, occupying the end of a spur which projects into a large plain, it is much exposed to the action of the wind, which is here very violent. The crop is composed of about 80 per cent. of silver fir, with a few spruce, 13 per cent. of Scotch pine, which have been planted or sown on the hot slopes, and 7 per cent. of beech; in addition to which, a few Weymouth pine, oak, alder and birch are found. The forest suffers greatly from the violence of the wind, so that about half the out-turn comes from wind-falls; this proportion, however, would probably have been less but for the large numbers of cankered trees found in the crop.

Before 1843 the forest was supposed to be selection worked, with an average annual yield of 77 cubic feet per acre; but Former treatment. latterly its regularisation by regeneration fellings and thinnings had been commenced.

In 1843 a working plan was made with four periodic blocks, and a rotation of 120 years; the blocks were not each in a ring fence. The annual capability was fixed at 63,003 cubic feet or nearly 50 cubic feet per acre, without counting the produce of the improvement fellings, such as thinnings. The actual annual yield per acre during these 80 years was 80 cubic feet. In 1873 another working plan was made which, without altering the length of the rotation, or of the periods, made new periodic blocks, each in a ring fence, and also prescribed that the rotation was to be started afresh from the date of the new plan. According to this plan the capability was fixed at 62,154 cubic feet annually. Regeneration fellings were to be made all over the first periodic block, and in two and four compartments of the 3rd and 4th blocks respectively. In the rest of the forest improvement fellings, removal of dying trees, thinning, etc., were to be made, whose yield was not to be included in the figures of the capability. The windfalls were so numerous that, in 1878, it was ordered that the "précomptage" of their volume was to be made on the capability, which was accordingly reduced to 53,146 cubic feet. It was

similarly reduced again, in 1889, to 41,686 cubic feet. The result of this was that the regeneration fellings could not be made properly, and in 1893 it was found that 396 acres of the forest were in the state of a normal irregular high forest, 740 acres were covered with a dense pole crop of silver fir, or Scotch pine, standing over silver fir advance growth, 181 acres were covered with thickets of silver fir poles and saplings, and finally, 277 acres had an open canopied forest of old silver fir, with plenty of advance growth. These types of crop were scattered over the whole of the forest, being never found on larger areas than 50 acres. At this time there were, on an average, 88 stems of 7.9 inches and upwards, in diameter, with a volume of 3,544 cubic feet, per acre; it was calculated that the forest should have at least 4,573 cubic feet to the acre, and it was supposed that it would have had this volume but for the fact of the numerous wind-falls.

It was evident that some alteration in the method of working had to be made. The Würtemberg system could very possibly have been successfully applied, but this involves much artificial reproduction work, and there are good reasons for objecting to it, at all events in France. The only alternative was the selection method, and this, modified apparently by the theories of M. Gurnaud, has been adopted; but the system prescribed is regarded as an experiment only, for, as will appear later on, there are serious objections to it.

The forest has been divided into four working circles of approximately equal area, but the volume of timber that they contain varies greatly, 5,141 cubic feet and 67½ cubic feet being the extreme averages per acre. In each circle the capability is fixed by the volume and by area. The volume capability is calculated according to the system prescribed in the note of 1883, the "old" trees and the "medium" ones being those of 17.8 inches in diameter and upwards, and those from 7.8 inches to 17.8 inches respectively. The area to be felled over is obtained by dividing each circle into a certain number of "coupons", of approximately equal area, one of which is to be worked over every year in each circle. The working plan states that the crop varies so greatly in different parts of the forest, that had the capability been calculated for the whole area, or even for each circle, there would have been little chance of making the richer compartments into normal irregular forests within a reasonable time. Therefore the capability was settled for each coupon separately, which causes the annual yield for each circle to vary greatly from year to year. To a certain extent the yield of one circle compensates that of another, and so there is less inequality in the total annual yield than might be expected; but, for the whole forest, the difference is very considerable, the extremes being 68,865 cubic feet and 38,918 cubic feet.

The following description of the working plans provisions for the first working circle shows how the details of the scheme are worked out. The rotation was fixed at eight years, in order not to damage the crop by too frequent felling works, while, at the same time, the forest could be worked over sufficiently often to enable dying and diseased trees to be

Treatment of the first circle.

removed when necessary. The area was therefore divided into eight approximately equal "coupons" with an average area of 48.1 acres.

The enumeration showed that in five out of the eight "coupons" there was an excess of "medium" trees, while in the remaining three "coupons" the proportion of "old" and "medium" trees was normal, that is their volume was as 5 to 3. Under ordinary circumstances transfers would have been made in the five "coupons," but as in that case non-exploitable trees would probably have had to be cut, and there would have been delay in introducing the normal state, it was decided that for all the "coupons" the capability was to be calculated from the volume of the "old" trees, and for the rotation of 8 years it was fixed in each coupon at $\frac{5}{3} = 1\frac{2}{3}$ of the volume of the "old" trees; which figure was to be revised at the end of 10 years. The volume of all the wind-falls of the size of the "old" trees was to be debited to the volume of the capability, but the volume of smaller trees, for whatever reason they were felled, was to be disregarded. The object of the treatment being to make the forest like a normal selection worked one, it was laid down that the young growth should be favoured as far as possible, and that the "medium" trees should not be felled, except when dying, or diseased, or when their removal in thinnings was necessary to bring the crop into its normal condition.

The working-plan claims for this treatment that, by introducing selection-working the number of wind-falls will be reduced. Speaking generally, it is by no means certain that, under the natural conditions which prevail in the Vosges, a regular forest, properly managed, cannot resist violent winds as well as an irregular one. Of course in this particular case the forest has never been converted from its original irregularity, and so it cannot be said that it has been properly managed from the point of view of the prevention of wind-falls; but, had the capability been calculated with the object of avoiding the "précomptage," which was applied in 1878, and 1889, at least the conversion might have been effected.

It is also claimed that, by the plan introduced, fewer non-exploitable trees are felled, than under the former system. This is true, but the former system was applied in order to convert the forest, and it is clearly not possible to convert an irregular into a regular forest without sacrificing some non-exploitable trees: the point to be decided is whether the future extra profits to be derived from a converted forest will counter-balance the present loss of "medium" trees during the process of conversion. In this connection it may also be noted that, this forest having been partly regularised at some sacrifice, a certain number of non-exploitable trees will still have to be cut in order to bring about the irregularity, thus involving further sacrifice. Moreover, it appears, as a matter of fact, that the fellings of "medium" trees are very considerable under the present system, for in five compartments that I visited no less than 61,693 cubic feet of such trees had been taken, against 135,329 cubic feet of trees taken in the principal fellings.

Even if it be admitted that the selection-worked forest is best suited to the local conditions, the advantages of the peculiar method adopted here are by no means clear, nor does it appear why it should be preferred to the ordinary method, especially if, in the latter case, the volume of

the "medium" trees felled were not debited to the capability. The system followed has the disadvantage of giving a most irregular annual yield, which perhaps is not a very serious objection to it, seeing that the country is very well wooded, and that this is a state and not a communal forest. A more important point against it arises from the fact that it sometimes happens that in a "coupon", the volume of wind-falls and dead trees, exceeds the volume of the capability. Or again, as I saw in one compartment, the volume of the wind-falls did not exceed the capability, but it was so large that all the big trees which required, culturally speaking, to be removed, could not be felled. In this particular compartment many of the big trees were dying, and also their removal was most necessary in order to uncover the promising advance growth, yet, owing to the manner in which the working plan was drawn up, they could not be touched. Had the capability been calculated for the whole area these, and similar other cases, could hardly have occurred.

There is yet another objection to this system, and that is that the local officers have to spend too much time in marking the fellings, for they find it difficult to select the trees—a difficulty which is quite comprehensible, but one which forms a very serious objection to the system. Finally, it may be noticed that the inconvenience caused by having fellings going on every year in four separate parts of the forest is very considerable.

Altogether it seems that the provisions of the plan are unpractical, and that the experiment is one which is not likely to be repeated.

(k) Conversion of deciduous into resinous forests in the Jura.

The Communal Forest of Ouhan is divided into two working circles, the lower one of which, whose area is 427·4 acres, is treated as a coppice with standards. The other, situated on the west side of a ridge separating the valley of the Loue from the plateau of the Vrigne, has an average elevation of about 2,800 feet and an area of 500·5 acres. The soil and general conditions here are extremely well suited to the production of silver fir, but the forest originally contained only oak, beech, hornbeam, etc., treated as a coppice with standards, with a little silver fir in a few small groups, and some scattered isolated trees. In 1866, 185·2 acres had been invaded by the silver fir from the neighbouring forests, and this species had established itself on them and formed a pole crop.

In 1866 a working plan was made which prescribed, (a) fellings by Working plan of volume in the few existing patches of old silver 1866. fir, (b) thinnings in the silver fir pole crops, with a periodicity of twelve years, and (c) coppice treatment of the rest of the forest combined with (1) reserve of all conifers; (2) removal of standards no longer required to give shade; and (3) artificial reproduction works of spruce.

In 1890 the treatment of the forest was again considered, and as it was found that the silver fir had spread naturally Working-plan of in a most extraordinary way under the old coppice, 1892. and that both this silver fir and the spruce which had been planted, were beginning to suffer from too much cover, it was

decided to abandon the coppice treatment altogether. The working plan of 1892 therefore prescribed the treatment of the crop as a high forest; and that is what is now being carried on.

The forest has been divided into four periodic blocks with a rotation of 144 years. Regeneration fellings are made in the old crops of silver fir, which are found in the first and fourth blocks. These are made on the same lines as those in the Pontarlier communal forest; they return to the same point about once in every eight years. In addition to this isolated old trees are felled, which interfere with young poles and saplings, and thinnings are made where necessary. In the third block, which is composed chiefly of a dense crop of silver fir about 80 years old, thinnings are being made. These crops have in some cases been left too long unthinned, or too lightly thinned, so that the thinnings now have to be made with great care. In one compartment, whose crop of silver fir was aged from 60 to 90 years, there were 240 stems of 8,575 cubic feet per acre, and the thinning in 1891 had only been able to take 456 cubic feet per acre: the stems were extremely tall with very small crowns, and it would not have been safe to fell more. The objects of the thinning have been attained, and the crowns having filled up the gaps caused by the fellings, further thinnings of the same kind will be made in 1899.

All over the forest, more or less, but mostly in the second block, the process of conversion from a deciduous to a coniferous crop is going on, and almost everywhere young conifers are found under the coppice with standards.

About one-fourth of the area has been planted with spruce at a cost of about 20s. an acre. A considerable part of this expenditure would have been avoided had it been known how quickly silver fir would spread by natural means. However that may be, the conifers are now in the forest, and all that has to be done is to enable them to survive by cautiously removing the deciduous stems which stand over them. This is done by means of improvement fellings, repeated in each place every seven years, in which all the young oaks and beech of good growth are carefully preserved, while other coppice shoots are cut back. The stems which are so left protect the young conifers, prevent, to a certain extent, the formation of undergrowth, and will eventually prove an asset of some value to the commune, serving to compensate it for the loss of the coppice fellings. They will of course be gradually removed as the conifers require to be opened out.

It is very noticeable how young silver fir spring up under the cover of large beech, whose shade protects them, and keeps down the undergrowth which would otherwise choke them. Certainly the operations have been very skilfully conducted, the young conifers are very healthy and form an almost complete growth under the deciduous trees. The commune will profit greatly by the operations, for instead of the former yield of 60 cubic feet, and 6s. 6d. per acre per annum which the forest produced before 1886, it has since given 58.5 cubic feet, and 18s. per acre per annum, and will without doubt give as much as the neighbouring silver fir forests, that is about 120 cubic feet yield, and 48s. net revenue.

I saw much the same treatment applied in certain parts of the communal forests of Salins, only there was more young oak than in the Ouhans forests, and the silver fir when once established did better in consequence. The use of beech in keeping down undergrowth, and allowing the silver fir to establish itself, is very marked.

(1) *A Compartment of Scotch Pine.*

Compartment E 3 of the communal forest of Senones is situated at an elevation of about 1,300 above sea level; it has a south easterly aspect, and is consequently very dry. The underlying rock is the Vosges sandstone, and the soil is very poor. This area was de-afforested some 60 years ago, and was afterwards planted with Scotch pine, in order to cover the soil. There is so much silver fir in the locality, for which there is a good market, that the pine was despised, and therefore was neglected, until about 25 years ago, when it was decided to underplant it with silver fir. This was gradually done, about 2,000 plants taken from the neighbouring forests being put in per acre at a cost of about 4s. Later on works were started in the neighbouring (forests?) for the manufacture of paper from wood pulp, and thus the pine assumed a value of nearly 3d. a cubic foot in the forest.

In consequence of the pine having no value except as a nurse, it was not thinned until it had attained the age of about 45 years, instead of at 25 years as should have been done. The result is that there are now too many stems in the forest, and so the trees have not been able to attain the diameter that they should have.

Thinnings have been made for some years past, and are repeated every five years. First of all the bad stems are taken, then the crowns of the best trees are opened out. The thinnings are at present very heavy, as much as 1,000 cubic feet per acre having been taken in one operation from a crop which had had about 570 cubic feet per acre taken from it ten years previously, and had also been thinned five years before that. From the appearance of the forest after the thinning had been made, one would think that too much had been taken, but the experience of former operations shows that this is not the case; on the contrary the good effect produced on the remaining trees is most marked.

The silver fir is doing very well underneath the pine, and will probably continue to do so until, at the age of 100 years, each tree will have a diameter of about 15 inches; then they will probably stop growing, and will have to be replaced artificially. The pine will probably attain an age of about 150 years, when its timber should be almost as valuable as that of the silver fir in the neighbouring forests.

II.—THE CONVERSION, NEAR NANCY, OF COPPICE WITH STANDARDS INTO HIGH FOREST.

There were, near Nancy, large areas of land covered with coppice under standards, composed of beech, and hornbeam, with a good deal of oak, and some ash, lime and other deciduous trees. With the idea that a regular high forest of these species would produce more oak, that the timber grown would be more suited to the present market requirements, that there would be a larger outturn, and that therefore a higher revenue would be obtained, it was decided to convert these crops into regular high forests. The conversion of many compartments has been successfully effected in accordance with the original scheme, but it is too soon to say for certain whether the operations will prove a financial success, and whether the desired result might not have been attained by growing the standards of the coppice closer together than used to be done.

The process of converting the coppice consists in fixing the rotation of the future high forests, and of dividing that into a certain number of periods, to which corresponding periodic blocks, of approximately equal area, are made. At the commencement of the operations the coppice with standards has to be felled over, the coppice being, say, 30 years old. A "coupe provisoire" is made in it, which consists in felling a very large number, almost all, of the old standards, and in leaving as many young trees as can be found suitable to form future seed bearers. In the crop which results from this felling, preparatory fellings are made after the lapse of one period of, say, 30 years, that is, when the majority of the standards are 60 years old. These preparatory fellings consist in (a) working over the area every ten years or so, and removing very cautiously the coppice shoots, so that eventually only one or two are left on each stool, and (b) cutting out the coppice shoots round the reserves, so that the reserves may be more or less isolated. The result of these fellings is that at the end of the second period the crop consists chiefly of young standards aged about 90 years, which have a considerable number of single, well-grown, coppice shoots, aged about 60 years, standing between them.

During the third period ordinary regeneration fellings, seeding, secondary and final, are made in this crop, which, at the end of the period, is regenerated, so that in the future it can be treated as an ordinary high forest, and can have cleanings and thinnings made in it.

There is a regular sequence arranged for these operations; during the first period ordinary coppice fellings are being made in the blocks other than that whose conversion is being undertaken. These are replaced in the second block, during the second period, by "coupes provisoires," while coppice fellings are continued in the remaining blocks; and so on for the other periods and blocks.

The regeneration fellings are made by volume after the seeding fellings are completed, and they are calculated on the number of years then remaining in the period.

The other fellings are made by area.

The following example taken from the Remensaumont forest explains the system. The seeding fellings were completed when 18 years of the period remained, the volume of the timber then was 756,778 cubic feet, to which was added the increment for 18 years which was:—

$$\frac{756,778}{3} \times \frac{18}{100} = 68,110 \text{ cubic feet, thus the capability was:—}$$

$$\frac{756,778 + 68,110}{18} = 45,827 \text{ cubic feet a year.}$$

The local officers fix, year by year, the compartments in which regeneration fellings are to take place, according to the state of the seedling crop in them. The other fellings are all made by area, and are laid down compartment by compartment, and year by year, for the rest of the blocks, according to the nature of the felling. Thus, in the above mentioned forest, it was stated that the coppice fellings, preparatory fellings, and thinnings were to be carried on annually over 15.2, 37.9, and 54.8 acres respectively, and the numbers of the compartments and years of felling for each were given.

Of course the general system as described above, is modified according to local circumstances. In one compartment that I saw, final fellings had been made without the ordinary regeneration operations, because there happened to be good oak reproduction. This had succeeded, but in another similar case it had failed, and as the oak standards are dying, artificial reproduction will have to be employed. Almost invariably, however, the natural reproduction of oak has been obtained in spite of the fact that the soil and climate of the forest is not particularly well suited to this species. There are late spring frosts, which affect both the flowering of the oak and its seedlings. The soil is diluvial in a good many places, and here it is fairly fresh, deep and fertile; but often it is too clayey, and shallow to be really good for the oak. Nevertheless, except in one or two hollows where spring frosts are very late and severe, and on some exceptionally dry, hot slopes, there was good natural reproduction of oak in every part of the forest that I visited.

Here, as in the Spessart forests, it is found almost impossible to attend properly to isolated young oak which spring up surrounded by beech seedlings, and therefore, as far as possible, the oak is induced to grow in small patches. A great deal is done, however, in the matter of cutting back the beech which surround isolated young oak. In Champenoux, for instance, the oak is opened out by the forest guards (who receive a gratuity for doing the work) at the ages of 5, 10, and 15 years. At the age of about 30 years regular thinnings are begun.

Planting, which is little resorted to, is also done in patches up to about two acres in area, but generally on smaller plots. In the converted compartments there is at present much more beech than oak. In one compartment, for instance, there was only about 15 per cent. of oak; but it is hoped that the proportion of beech will be reduced during the next revolution.

The figures of production at present available are of no use for comparing the results of these operations with those which used to be carried on when the forests were entirely under in coppice with standards. Before any such comparison can be made profitably, a converted block will have to have passed through an entire revolution.

III.—AN ORDER ON THE TREATMENT OF SELECTION- WORKED FORESTS.

Two years ago I called attention, in the columns of the *Indian Forester*, to the fact that, according to modern ideas, thinnings are required in selection-worked forests. The extent to which the original theory of management of such forests has been modified can well be seen from the following translation of an extremely clear note, by the French Administration, written in 1891, on the treatment of “*futaies jardinées*” :—

“ Trees to be felled are :—

1st.—those of all age classes which are dead or decaying,

2nd.—those which are exploitable and, at the same time, are not required for seed-bearers, or to maintain the crop in its proper state as a normal selection worked forest,

3rd.—those which, not having reached the exploitable size, prevent partial regeneration, or which, being too numerous, hinder the development of the best stems of the future.

Forest officers must remember that the selection method is not an empirical one in which, subject to the limit of the capability, only dead, dying, or very large trees are removed, leaving the rest of the crop to take care of itself. The operations required are the same as in a regular high forest : seeding, secondary, and final fellings, with thinnings and cleanings. The difference between the selection and the regular high forest methods is, that in the latter the cultural operations are carried out over a single definite coupe, whilst in the former they take place over the whole extent of the forest on small areas, whereby the different kinds of fellings are, so to speak, mixed up one with the other. It follows that, in a selection worked forest, one is not limited to the felling of large timber only. On the contrary, all kinds of cultural operations must be carried out in it : opening out advance growth, thinning crops where too dense, and removing poles with no future. The fact must not be forgotten that the most profitable growth in the forest is that which is obtained from the choicest stems that are not intended to be felled until they have reached their exploitable size. At the same time it is necessary to guard against the tendency to regularise the forest by creating single-aged crops on areas of considerable size.”

I may add that the general theory of selection working, as contained in the above extract, was practised, in certain forests in France, previous to the issue of this note. It has also been practised in Germany.

IV.—COPPICE WITH STANDARDS IN KIPPENHEIM.

(Baden.)

The Kaiserwald forest is situated in the Kippenheim district near Offenburg, in the Rhine Valley. It is about 550 feet above sea level, and has an area of rather more than 360 acres. The soil is loamy sand, fresh and deep, with plenty of humus, and although a good deal of gravel is found in it, yet it is of excellent quality. Water lies very near the surface, even in the driest summers being found at a depth of not more than 5 feet. The principal species are ash, oak (*Q. pedunculata*), alder, elm, hornbeam and sycamore; in addition to which birch, hazel, poplar, willow, and other trees are found. Ash occurs almost everywhere, but it does best in the moist ground, where it has a fine growth, trees of sixty years of age being nearly 80 feet high as a rule, while those of 90 years are nearly 100 feet high. Oak grows well in the drier places, and alder in those which are excessively damp.

The forest is managed as a coppice with standards, on a 30 years' rotation, and there is but one cutting series of 30

Treatment. coupes for the whole of it. The length of the rotation has been fixed in order that, as the main object sought is to secure a good overwood of ash and oak, the underwood may force the standards to attain a considerable height, and may give them long clean boles: and this object has been most successfully effected.

Fellings are regulated by volume, and at each cutting about two-thirds of the standing material is removed, that is, about 2,400 cubic feet per acre. The trees over 90 years of age are, as a rule, all taken at this time, though occasionally some of the finer oaks are left. In addition to this all the underwood, except naturally sown poles of the more valuable species, is removed, as are badly shaped, or unsound, trees of the two intermediate classes, so that the standards left to produce the final yield of timber are trees of the best obtainable quality.

The number of standards left varies, in different compartments, by very considerable quantities; indeed the numbers are not considered at all except in a very general way. At the same time it is sought to leave them in groups rather than as isolated trees, in order to produce as fine timber as possible; and these groups are easily formed, since a great deal of planting, both of oak and ash, has to be carried on. The following example of the number of standards left in one compartment is interesting:—

Diameter of stems in inches.	Number of stems per acre.
7·9 to 11·8	80
11·8 to 15·7	79
15·7 to 19·6	27
19·7 to 22·6	12
Over 22·6	13

The total number of stems left per acre was 211, whose volume was 2,600 cubic feet.

Cleanings of the coppice are prescribed at the end of the first ten years, and again ten years later; but they are made at times other than those laid down in the working plan, should any special reason render it advisable to do so.

For example, this recently happened in compartment 18, where the hazel was suppressing the ash, and had to be cut back two years before the appointed time. The first cleanings bear chiefly on the coppice shoots of inferior species which interfere with, or dominate, the future standards, but opportunity is taken to remove certain other undesirable material at the same time. These cleanings are heavy, and after they have been made the forest looks extremely open; but the canopy soon closes up again. At this time the standards are pruned if they require it. The second cleanings are made with great caution, so as not to interrupt the leaf canopy; badly-shaped and dying stems are removed, as also are those of inferior species which overtop valuable ones. The care which is taken not to interrupt the leaf canopy is most noticeable; in not a few places inferior trees are simply branched, or topped.

All these operations are conducted with great judgment, and much trouble is taken over them, for on their success depends to a great extent the value of the standards. It is true that I saw one or two places in which it appeared that the cleanings had been somewhat delayed; but, where there was serious necessity for undertaking them before the prescribed time, the work appeared to have been done. Although their proper execution demands a great deal of careful supervision, yet the actual operations are conducted at a profit, as the following figures show:—

	Cleanings at 10 years of age.	Cleanings at 20 years of age
Area in acres	11 9	13 18
Volume of produce, cubic feet	1,814 15	2,282 07
Cost of works including removal of produce, shillings	190	120
Sale of produce, shillings	313	337
Profit, shillings	123	217

The planting consists chiefly of ash, but a good deal of oak is also

put out, and in moist ground alder. As an example I may mention that in one compartment I saw 440 ash, 20 oak, and 104 alder, put out per acre. Over the whole forest, on an average, 550 ash are put out per acre every 30 years, but many of them die, and at the end of 30 years about 200 only are left alive. The ash are planted in large pits about 18 inches square and 12 inches deep; they are taken from their nursery at the age of 4 or 5 years, when they are from 4 to 8 feet high. The average cost of planting 1,000 ash, including nursery charges, is about 36s., the price of daily labour being about 1s. 9d.

V.—OAK AND SCOTCH PINE AT VIERNHEIM.

(Hesse Darmstadt.)

The forest of Viernheim is situated on a level plain in the Rhine Valley, some 350 feet above sea level. Its area is 4,645·8 acres, and it is divided into rectangular compartments, each about 54 acres in area. The surface is undulating, and the soil is diluvial and sandy, but it gives a fairly good yield in timber on account of the water which it contains in considerable quantities at from 3 to 6 feet below the surface. Oak (*Q. pedunculata*) worked on a rotation of 160 years, and Scotch pine worked on a rotation of 120 years, are the principal species found in it, the latter being on the high ground, and the former in the lower parts.

The chief point of interest about this forest is the manner in which the reproduction of oak is obtained, for, owing to the nature of the soil, and to the lateness of the spring frosts, it is practically impossible for it to be regenerated naturally. So a system of planting it, in combination with agricultural work, was devised in 1810, and has been continued ever since, with slight modifications from time to time. In addition to the use made of field crops, an essential part of the system is the raising of Scotch pine with the oaks, and former acting as a nurse to the latter, and protecting it from the spring frosts.

A clean felling is made, the trees being felled by digging round the roots, of which the larger ones are then cut, so that the trees are made to fall in any desired direction, and no stools are left in the ground. Then the ground is ploughed, and oaks and Scotch pines are put in, either in alternate lines, or better, on account of the rapid growth of the pine, in two lines of oak to one of pine. The lines are about 4 feet apart, and between them potatoes are grown for two consecutive years, and then rye and wheat for one year. After this the oak and pine are left to grow up together until they have attained the age of about 15 years when the pine is topped, and so, after the operation has been repeated once or twice at intervals of several years, gradually dies off, leaving the oak alone. A few years later thinnings are made in the oak. These have to be made cautiously, and if they are put off too late the oaks lie down with the weight of their own crowns, or of the snow on them. Equally, the topping of the pine must be made in time, for otherwise the oak is suppressed and never recovers. The result of both these kinds of neglect may be seen in the forest. The thinnings of the oak do not require to be continued for more than a few years; they are recommended later on when the crop is about 80 years old. It seems that they should be made sooner for, at that age of the crop, they have to be made too strong.

The pure oak crop is underplanted with beech at the age of about 40 years, in order that the soil may be protected and improved. Similar underplanting of the pure Scotch pine crops is also sometimes made. For administrative reasons the beech in parts of the forest is coppiced fre-

quently, but it serves its purpose all the same, especially in the pine covered areas. In one place where the beech had not been coppiced it appeared to be catching up the oak over-wood.

It has generally been the practice to sow the oak very thickly, and to plant the pine about 4 feet apart; but the oak has occasionally been planted, a method which has the disadvantage of giving less choice in the matter of the first thinnings: on the whole, sowing appears preferable to planting.

Formerly lines of oak and pine had a direction given them from east to west, because the prevailing wind is from the west, and it was thought that, striking freely through the stems, it would reduce the bad effects of the spring frosts. This system has been changed, and the lines are now made from north to south, so that the outside trees may protect the others from the morning sun, whose effect is to intensify the damage resulting from the frosts.

Up till 1870 the re-stocking operations were actually conducted at a profit of about 50s. an acre, but, owing to the fall in agricultural prices, this has been converted into a loss of about 24s. an acre. If, however, the re-stocking were not combined with agriculture, the cost would now be, instead of 24s., probably at least 64s. an acre.

Assuming the necessity for raising oak the system adopted seems to be a good one. The cultivation impoverishes the soil to a certain extent, by reason of the crops raised; but, on the other hand, it works the upper soil, mixing the humus with it, it necessitates the destruction of weeds and grass, and the plants raised are stronger and less subject to the effects of spring frosts than if there were no cultivation. The final point in its favour is that, the stools being uprooted, insects cannot be harboured by them.

The results obtained in this forest, as shown by the measurements of a sample area in a fairly representative crop, are good, considering the local circumstances. An oak crop of 31 years of age gave 140 stems, with an average height of 89·8 feet, and a volume of 5,473 cubic feet to the acre. If the volume of past thinnings be added to this it appears that the average annual yield per acre has attained the very high figure of 88·5 cubic feet.

Mr. Fernandez has suggested that a modification of this system might be applied to the raising of teak plantations in the Central Provinces, and I am not at all sure that we might not make use of it in parts of the Himalayas for the purpose of extending deodar forests into some of the numerous existing bare areas suitable for its production. In many parts of the Kulu division, for example, there is some demand for land for the purposes of cultivation, and it is quite possible that Zamindars would undertake to raise deodar in lines, from seed, in return for the free use of the rest of the land for crops during several years. It would probably be best to allow only winter cereal crops to be sown, in order not to impoverish the soil too much, and to reduce the damage done to the deodar by

frequent cultural operations. If the cereals were sown late they would protect the young plants during the early part of the hot weather, when, at all events in a dry season, they have most need of shade: not that deodar cannot survive hot seasons in many parts of Kulu, when it grows out in the open. Crops could possibly be raised for four, or even five years in succession, when the deodar should be left to itself. Of course, a good deal of supervision would be necessary, and it would not be easy to get Zamindars to work the system fairly; but I think it might be done, and in any case, that it is worth trying.

VI.—THREE DIFFERENT METHODS OF TREATING RESINOUS FORESTS IN GERMANY.

(a) *Herrenwies (Baden).*

This forest is situated in the Grand Duchy of Baden at a mean elevation of about 2,500 feet. The slopes are somewhat steep, and the underlying rock is chiefly Buntersandstein in the upper, and granite in the lower parts. The soil is generally good, fertile, and well suited to forest growth. The whole area is divided into three classes of forest, according to the productive capacity of the soil. In this note forests belonging to the most productive class, *i.e.*, that which produces 48 cubic feet and upwards, of good timber, per acre, per annum, are referred to. The trees found are spruce and silver fir, with a good deal of beech, and a few other species, which occur mostly as isolated trees.

Originally the forest was worked by the selection method; but it was badly applied, and the best trees only were removed, those badly grown, or diseased, being left. **Former treatment.** Later on it was attempted, in some parts, to obtain natural regeneration in long periods of sixty years, the rotation being 120 years. Finally, in 1883, it was decided that the regeneration should be effected in periods of 30 years, so that eventually each compartment should contain a uniform age-crop; but the proposed conversion was to be effected very slowly in order to avoid, as far as possible, waste of material.

The present system has the object of creating a regular forest of spruce and silver fir, with a rotation of 120 years, but it has not yet had time to find full expression, and may be modified later on; subject to this reservation it may be described as follows. **Present prescribed treatment.** The forest is worked over in fairly light thinnings every 15 or 20 years, up to the age of 90 years, when a heavy thinning is made, which opens out the crowns of trees of the future. At about 105 years of age trees are marked for what is called a preparatory felling, which is really a light seedling felling made for the benefit of the silver fir; when advance growth of this species has been obtained, secondary fellings are made, which secure the reproduction of the spruce. After the final fellings any blanks left are planted up with spruce. The first thinnings are not sufficiently heavy to interfere with the struggle for existence, and the thinnings in crops of 90 years of age being heavy allow trees to put on considerable diametral increment. Since the regeneration period is 30 years, and the seedling fellings are commenced at the age of 105 years, it follows that, after the heavy thinning, trees will have from 15 to 45 years in which to put on diametral increment.

Owing to the way in which the forest has been worked there is much inequality in the present crop, and the treatment now being applied is consequently very varied in different parts of the forest. **Conversion operations.** In one compartment that I visited there had been an over-wood of spruce and silver fir, with some beech, standing over young beech. Some 20 years before the regeneration began a thinning had been made in the over-wood, but it was light, and the crowns of the spruce and silver fir had filled up the gaps it caused. To secure regeneration the beech under-wood was

removed, and a light felling made to allow the silver fir to establish itself; later on more fellings were made in order to allow the germination and growth of the spruce. Finally, the blanks caused by the last fellings were planted up with spruce, and a few beech having been left till the last cutting, a mixed crop of spruce, silver fir, and beech was obtained in a period of 80 years.

The conversion operations may be said, generally speaking, to consist of removing the old trees, and also the comparatively small stems which are too old, or which have been too long suppressed, to be able to form part of the future crop; at the same time, blanks are planted up with spruce, and, if necessary, cleanings are made. The removal of comparatively small stems which have grown up much suppressed by big trees, and are even much older than they look, is a marked feature of the conversion treatment. Of course to remove them entails waste of material, but the waste is not considered to be of much importance, since it is said that they will never be able to produce decent timber. It is pointed out that the space occupied by these trees is immediately filled up by good advance growth, introduced naturally, or artificially, as the case may be.

All thinnings are made solely with a view to the sylvicultural requirements of the forest; the yield they may produce is not considered when trees are being marked for them. When the crop contains practically nothing but spruce and silver fir, the first thinnings are made at the age of about 45 years, and only diseased and much suppressed trees are removed. At the same time care is taken, while leaving enough stems to ensure the falling of the lower branches, not to leave more than the soil can support, as used to be the universal practice. Trees are marked for another thinning about 20 years later, with the same object; but the third, which is made when the crop is about 90 years old, removes all bad stems, and opens out the trees of the future, enabling them, as said above, to put on diametral increment.

The following statement shows the result of marking a typical thinning in a compartment whose crop, the result of a long period of regeneration, had an average age of about 70 years. The elevation was 2,500 feet above sea level, the aspect north, and the slope gentle. The soil, resulting from the disintegration of the Buntersandstein, was a sandy loam with a moderate admixture of boulders; it was fresh, and well covered with moss. The crop was almost entirely composed of silver fir and spruce, in the proportion of 6 to 4. The figures refer to the results reduced to one acre in area.

	The thinnings.			Remaining after the thinnings.		
	Silver fir.	Spruce.	Total.	Silver fir.	Spruce.	Total.
Number of stems . . .	45	81	126	365	184	549
Sectional area, square feet	20·6	30·6	51·2	308·5	124·6	433·7
Mean height, feet . . .	52	49	...	64·0	62	...
Volume of timber, cubic feet	345·8	169·1	514·9	4,215·7	1,629·2	5,844·9
Total volume	411·3	217·7	629·0	5,001·8	1,948·5	6,945·3

Up to the present time it has not been found possible to obtain natural reproduction of more than about two-thirds of the area regenerated; the rest has accordingly been planted. In the future, that is, when the forest has been brought into a regular state, it is expected that, with periods of 30 years, it will be possible to regenerate five-sixths of the area naturally; this is only an estimate which, as spruce and silver fir both seed freely in the locality, seems a reasonable one.

(b) *Palzgrafenweiler (Württemberg).*

The forest of Palzgrafenweiler, which contains silver fir and spruce, mixed with some beech, is treated as a regular high forest with a rotation of 120 years, divided into six periods of 20 years each. It is split up into working-circles, and each circle is divided into six periodic blocks, which either are, or eventually will be, approximately equal in productive capacity, that is, speaking generally, approximately equal in area. Each block is regenerated in its corresponding period of 20 years, by natural means as far as possible, but if necessary by planting. Thinnings are commenced at the age of about 20 years, and are repeated every 20 years. They are made light, their volume having averaged annually, during a period of five years, less than one-seventh of the entire volume removed. In Reichenbach, a similar neighbouring forest, during the same period, they produced only one-fifteenth of the total volume removed.

The annual yield is calculated on the crop contained in the block under regeneration, and is taken in principal fellings, the volume of the intermediate fellings not being considered for its realisation.

A mixture of about 45 per cent. each of silver fir and spruce, and 10 per cent. of beech, is sought to be obtained. In regenerating the forest it is necessary to give the young silver fir a start of the spruce, for the latter grows the faster of the two. Furthermore, the silver fir is a shade-demanding species, and if the soil were too much uncovered by the seeding fellings, it would probably not establish itself at all. For these two reasons a seeding felling is made light, and the crop is not again cut for five years when a series of regeneration fellings remove the rest of the trees. It follows that, practically, the spruce has to be regenerated in 15 years. This is impossible, in spite of the fact that spruce seeds profusely, and the result is that much planting has to be done; indeed, during the last seven years, very nearly two-thirds of the area felled over has been planted. The area to be planted is increased by the removal, with the regeneration fellings, of such isolated naturally sown seedlings as, having sprung up previous to the fellings, and having lived in a suppressed state for some time, are considered to be unable to develop into good stems, owing to their tendency to become too branched.

It is now thought that the seeding fellings have not hitherto been made sufficiently heavy even for the silver fir, and consequently more stems are being removed in them. This will probably reduce the amount of planting work required, but the fact remains that, with so short a regeneration period, much artificial reproduction will always have to be carried out. The mixture of beech, though it undoubtedly improves the

soil, and so causes the production of finer timber, is a fertile source of difficulty for obtaining natural reproduction. Beech establishes itself very rapidly as soon as the canopy is lightened, and thus often interferes to such an extent with the advance growth of silver fir and spruce that it has to be removed at a considerable cost.

The planting of silver fir and spruce is costly. These species are planted in spring, when they have attained the age of four years. About 3,200 plants per acre are put out, and, with the necessary repairs, these cost, including the formation and maintenance of nurseries, not less than 70s.; the price of daily labour being high.

Assuming that it is better to grow spruce and silver fir, in these districts, as regular rather than as irregular high forests, it is not clear wherein lies the advantage of having such short regeneration periods. They necessarily result in much artificial reproduction, whose cost at compound interest should be deducted from the net revenue of the forest calculated at the end of each revolution. In the Jura with mixed forests of spruce and silver fir, and long regeneration periods, practically no planting is required, and yet the Jura forests produce timber typical of that grown in a regular crop. It is true that the yield here is slightly higher than it usually is in the Jura, and this may be due to the admixture of beech which does not exist there, an admixture which considerably increases the difficulties of obtaining natural reproduction. Even with this increased out-turn, it seems doubtful whether the large expenditure on planting is compensated for.

Comparisons of this sort are, however, of little practical value; the elements which combine to produce the forests as they now are differ to such an extent that it is impossible to strike a balance between the results obtained. Long regeneration periods have been tried here and abandoned; it may be that, if they had been applied as are those in the Jura, they would have succeeded, but it is impossible to say.

In these forests there is considerable danger of the wind doing damage in the areas under regeneration. In order to minimise this, and also to avoid the deterioration of the soil which results from having large areas felled over at one time, a number of small felling series are made by subdividing the large ones by "severance cuttings."

The manner of making these severance cuttings is described in Volume III of Dr. Schlich's *Manual of Forestry*. It is claimed that by their means a regular high forest can be sufficiently sub-divided into small cutting series, so as to enable it to withstand the effects of ordinary violent winds as well as an irregular high forest can do; and the claim seems to be justifiable.

(c) *Oberwolfach (Baden).*

The Oberwolfach Communal Forest is situated partly on the top of a ridge, and partly on a somewhat steep hillside, at a mean elevation of about 2,500 feet above sea-level. The soil, which is loamy, fairly moist,

and good to moderate for forest growth, has Buntersandstein underlying it in the upper, and central parts, and gneiss along the lower edge. The species it contains are silver fir, spruce and beech with a few other deciduous trees; of these the silver fir covers about 62 per cent. of the area, the spruce about 36 per cent. and the beech about 1 per cent.

The forest is treated by the selection method, and, with a rotation of 120 years, has regeneration periods of 50 to 60 years, so that about half the area is always in a state of regeneration. A working plan is made every ten years, and, on the results of the complete enumeration of the stock, the yield is then calculated. This yield is fixed by adding the actual increment to the real growing stock, by then deducting from the figure so obtained the normal growing stock and dividing the result by ten, the number of years in the rotation. Thus, for the current working plan, the yield was, in cubic feet:—

$$\frac{1,038,279}{10} + \frac{6,846,285 - 6,858,999}{10} = \frac{1,025,565}{10} = 102,556 \text{ cubic feet.}$$

At the time that the working plan is made, notes are taken about the diseased and unsound trees in the forest, so that it is possible to lay down, for each compartment, that a certain volume of sound exploitable trees, and a certain volume of unsound trees of all sizes, as well as of sound small trees, whose removal is desirable for cultural reasons, have to be felled during the ten year period. For instance, the present working plan states that, in one particular compartment, 282,525 cubic feet of sound exploitable trees, and 211,894 cubic feet of other trees, have to be felled.

The year in which each compartment is to be felled over is not laid down in the working plan; there is not, what we call in India, "a felling statement." All that the divisional officer has to do is to make proposals, in his annual plan of operations, about the compartments to be worked over in the ensuing year, and then to remove the prescribed volume from them, within a margin of 5 per cent. either way. This seems to be an extremely sensible arrangement, and one that we might adopt, with advantage in India. With us, however, since the areas to be dealt with are so large, and since divisional officers are so frequently transferred from one district to another, it would be well that a working plan should contain a "felling statement" to show year by year which compartments will probably require to be worked over; but this statement should only be used to give an indication to the divisional officer, and to assist him in drawing up his annual plan of operations.

If, as may happen, there is in any one year, an excessive number of windfalls, or of diseased trees, special arrangements have to be made in order to remove them, and the provisions of the working plan have to be departed from. Under ordinary circumstances, however, sound exploitable trees are marked last, that is, after unsound or small trees have been taken. If the volume of these last is found to be larger than was anticipated in the working-plan, then less than the prescribed volume of sound exploitable trees is removed.

In marking trees for felling the cultural requirements of the forest are always considered first of all, so that the first trees selected are those

which, whatever their size may be (a) are cankered; (b) have been injured in any way; (c) are unlikely to make good stems, being crooked, much branched, etc.; (d) are apparently unhealthy and likely to die prematurely; (e) have been altogether suppressed; and (f) require to be pruned, but have such thick branches that they cannot stand the operation. In all these operations the forest officer is not hampered by the fear of unduly uncovering the soil because, except in a few rare places, there is excellent natural reproduction of the valuable species.

Planting is only resorted to under special circumstances, and it may

Minor operations. be said that it is not really required in the forest. Considerable attention, however, is paid to pruning, this operation being considered essential in crops which are really selection worked, for it is thought that, without it, advance growth beneath large poles or trees would be too much suppressed. It is also said that pruning improves the quality of the timber, and, to this end, special attention is paid to the pruning of those silver fir which are intended to be left standing until the end of the revolution; it is found that spruce will not stand pruning, being liable to rot from the scars made by the operation. The pruning which, if it has to be heavy, is made in several operations, is generally commenced when the trees are about 40 years old, and about 20 feet high. For trees of this height it is carried up to about half the length of the bole; but for the largest trees it goes on as far as two-thirds of the height. It is made by the aid of climbing irons, and costs about 6*d.* for each big tree, the price of daily labour being about 2*s.* 6*d.*

Remarks. This forest is purely selection worked, but there are a few small areas in it in which the trees are even-aged, some being young pole-crops, others open crops of old trees standing over advance growth, while others again are covered with middle-aged trees. There is no intention of irregularising the crop in these patches, but they are so few in number that the forest may be said to contain, over its whole area, trees of all ages mixed together. It is claimed that the out-turn is higher than it would be were the forest treated by a regular system, and figures of out-turn are adduced to prove this which show that, during the last 20 years, 110 cubic feet have been removed per acre yearly, while, at the same time, the standing volume on each acre has increased annually by 102 cubic feet. No doubt these returns are extraordinary, but in order to be able to appreciate the second one, it would be necessary to know the state of the crop when the first enumeration was made, for it may have been abnormally young. However that may be, and assuming that the enumeration figures are reliable, it is certain that there is no evidence available to prove whether, in this particular case, a regular or an irregular forest would produce the finer results. The local officer, who is considered to be an extremely able forester, believes in the existing system, and it is hard to think that any other method could produce finer results than this has done; but it entails an immense amount of labour to carry out the minute operations involved, probably more than would be necessary were the forest a regular one.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

13th December, 1898.—No. 942F.—The following transfers are ordered in the interests of the public service :—

- (i) Mr. H. S. Ker-Edie, Assistant Conservator of Forests, 1st grade (Officiating Deputy Conservator, 4th grade), Assam to Burma.
- (ii) Mr. W. F. Perreé, Assistant Conservator of Forests, 1st grade (Officiating Deputy Conservator, 4th grade), Burma to Assam.

13th December, 1898.—No. 945F.—The following transfers are ordered in the interests of the public service :—

- (i) Mr. T. J. Campbell, Deputy Conservator of Forests, Assam, to the North-Western Provinces and Oudh.
- (ii) Mr. W. A. R. Doxat, Assistant Conservator, North-Western Provinces and Oudh to Assam.

30th December, 1898.—No. 1003F.—On return from the furlough granted him in the notification of this Department No. 281-F., dated the 19th April last, Mr. C. Bagshawe, Conservator, 1st grade, resumed charge of the Berar Forest Circle from Mr. W. P. Thomas, Officiating Conservator, 8rd grade, in the forenoon of the 16th December, 1898.

From the same date—

- (i) Mr. E. P. Dansey, Conservator, 2nd (Officiating 1st) grade, North-Western Provinces and Oudh, reverted to his substantive grade.
- (ii) Mr. Thomas, Officiating Conservator, reverted to his substantive appointment of Deputy Conservator, 1st grade, Central Provinces.

2.—MADRAS GAZETTE.

7th December 1898.—No. 561.—The privilege leave for one month granted by the Board of Revenue to M. R. Ry. V. Alwar Chetty Garu, Extra Assistant Conservator of Forests, notified at page 1442 Part II of the *Fort St. George Gazette*, dated 8th November 1898, is extended by two months under article 291 of the Civil Service Regulations.

14th December, 1898.—No. 574—

No.	Name and designation of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	M. R. Ry. V. A. Parthasarathi Mudaliyar Avargal, Forest Assistant, Office of the Board of Revenue, Land Revenue.	...	Extra Assistant Conservator of Forests, Second Grade.	Permanent.	<i>Vide</i> G. O. Mis. No. 3028, Revenue, dated 19th July 1898. To rank as second in the grade.

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14th December, 1898—No 575—

No.	Name of officer.	District	Nature of charge.	Remarks.
1	M. R. Ry. V. A. Parthasarathi Mudaliyar Avargal, Extra Assistant Conservator of Forests, Second Grade.	.	Forest Assistant, Office of the Board of Revenue, Land Revenue.	<i>Vide</i> G. O., No 358, Revenue, dated 27th June 1898, and G. O. No. 710, Revenue, dated 14th Novr. 1898.

APPOINTMENTS.

17th December 1898.—No. 576.—

No.	Name of officer.	Present grade.	Grade to which promoted or reverted.	Nature of promotion or reversion.	Remarks, showing cause of vacancy, &c.
1	Mr A. W. C. Stanbrough	Deputy Conservator of Forests, Second Grade	Deputy Conservator of Forests, First Grade.	Acting ..	With effect from the date of Mr. Stanbrough's return to duty.
2	Mr. A. W. Lushington	Deputy Conservator of Forests, Third Grade, and acting in the First Grade.	Deputy Conservator of Forests, Second Grade	Do. ..	
3	Mr E. R. Murray	Deputy Conservator of Forests, Third Grade, and acting in the Second Grade.	Deputy Conservator of Forests, Third Grade.	Permanent	
4	Mr. C. DuPré Thornton	Deputy Conservator of Forests, Fourth Grade,	Do.	Acting ..	With effect from the date of Mr. Thornton's return to duty.
5	Mr. H. B. Bryant	Deputy Conservator of Forests, Fourth Grade, and acting in the Third Grade.	Deputy Conservator of Forests, Fourth Grade.	Permanent	
6	Mr. H. F. Arbuthnot	Assistant Conservator of Forests, Second Grade, and acting in the First Grade.	Do.	Acting ..	During the absence of Mr. F. O. L. Cowley-Brown on furlough, and until the return of Mr. G. B. Brasier from special leave.

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17th December 1898.—No. 577.—

No.	Name and designation of officer.	District.	Nature of charge.	Remarks.
1	Mr. C. DuPré Thornton, Deputy Conservator of Forests	North Arcot.	District Forest Officer.	This cancels Mr. Thornton's appointment to the Trichinopoly district notified in notification No. 530 published on page 1148 of Part I of the <i>Port St. George Gazette</i> , dated 22nd November 1898.
2	M. R. Ey. V. Alwar-Chetty Garu, Extra Assistant Conservator of Forests, on privilege leave.	Trichinopoly cum Tanjore.	Acting District Forest Officer.	Vice Mr. H. A. Latham on other duty. To join at once. This officer is recalled from his privilege leave under article 223, Civil Service Regulations.

3.—BOMBAY GAZETTE.

6th December, 1898.—No. 4242.—Messrs. G. P. Millett, Deputy Conservator of Forests, and R. S. Pearson, Assistant Conservator of Forests, 2nd grade, respectively delivered over and received charge of the Sub-division Forest Office, Nasik, on 11th November 1898, in the afternoon.

12th December, 1898.—No. 6206.—Mr. Ganpat Ramji Mane, Extra Assistant Conservator of Forests, 4th grade, who was posted to Northern Division, Kanara, as Sub-division Forest Officer, assumed charge of his duties as such on the forenoon of the 3rd instant.

19th December, 1898.—No. 6367.—Messrs. W. R. Woodrow, Deputy Conservator, and V. D. P. Rebeiro, Extra Assistant Conservator, respectively delivered over and received charge of the Dharwar Forest Division on the afternoon of the 7th instant.

4.—BENGAL GAZETTE.

19th December, 1898.—No. 3814.—Babu Guru Das Chatterjee, Extra Assistant Conservator of Forests, 4th grade, in charge of the Chaibassa Range, Singhbhum Division, is transferred to the Palamanu Forest Division, of which Division he will hold charge, during the absence on furlough, of Babu Sreedhar Chuckerbutty, Extra Assistant Conservator of Forests, or until further orders,

5.—N.-W. P. AND OUDH GAZETTE.

16th December, 1898.—No. ⁴⁴⁹⁷_{11 835 B.} Pandit Sada Nand Gairola, Extra Assistant Conservator of Forests, attached to the Jaunsar Forest Division of the School Circle as Working Plan Officer, to be attached to the Direction Forest Division of the Oudh Circle in the same capacity.

22nd December, 1898.—No. ⁵⁴⁹⁷_{4 861 B.} Mr. J. T. Campbell, Deputy Conservator of Forests, 4th grade, who has been transferred to these Provinces, to the charge of the Naini Tal Forest Division of the Central Circle.

6.—PUNJAB GAZETTE.

5th December, 1898.—No. 509.—Mr. Fazl-ud-din, Extra Assistant Conservator of Forests, on return from the furlough granted by Punjab Government Notifications Nos. 51, dated 25th January 1897, and 201, dated 4th May 1898, reported his arrival at Bombay on the forenoon of the 4th November 1898, and at the office of Conservator of Forests, Punjab, Lahore, on the forenoon of the 9th idem. He remained attached to the Direction Division until the afternoon of the 14th November 1898, and took over charge of the Montgomery Division on the forenoon of the 16th November 1898 from Lala Danlat Ram, Extra Assistant Conservator of Forests, deputed to the estate of Raja Sir Amar Singh, K. C. S. I., of Kashmir.

12th December, 1898.—No. ⁸²⁶_{A L 400 23.}—Mr. A. J. Gibson, who has been appointed an Assistant Conservator of Forests of the 2nd grade and posted to the Punjab, reported his arrival at Bombay on the forenoon of the 18th November 1898, and at Lahore on the forenoon of the 29th idem, from which date he has been attached to the Lahore Division.

20th December, 1898.—No. 538.—His Honor the Lieutenant-Governor is pleased to approve of the following appointments and reversions in the list of Extra Assistant Conservator of Forests in the Punjab:—

With effect from 8th December 1898.

Ranger Ghulam Muhammad (1) to be Extra Assistant Conservator, 4th grade, on probation in the vacancy caused by the retirement of Babu Latha Singh, Extra Assistant Conservator.

Lala Rama Nand, Probationary Extra Assistant Conservator, 4th grade, to revert to the rank of Ranger, 1st grade.

Ranger Gokal Das, at present on deputation to the Marwar State, to be Extra Assistant Conservator, 4th grade, on probation in the vacancy caused by the reversion of Lala Rama Nand to the rank of Ranger.

Ranger Thakur Das to be Extra Assistant Conservator, 4th grade, provisionally, vice Lala Danlat Ram, Extra Assistant Conservator, deputed to the estate of Sir Raja Amar Singh, K. C. S. I., of Kashmir.

With effect from 9th November 1898.

Lala Sunder Das, Officiating Extra Assistant Conservator, 4th grade, to revert to the rank of Ranger, 2nd grade, consequent on the return from furlough of Mr. Fazl-ul-din, Extra Assistant Conservator.

From 9th November 1898, to 7th December 1898.

Lala Sundar Das to officiate as Extra Assistant Conservator, 4th grade, in the vacancy caused by the retirement of Babu Ladha Singh.

With effect from 8th December 1898.

Lala Sundar Das to be Extra Assistant Conservator, 4th grade, provisionally. *vice* Gokal Das, Probationary Extra Assistant Conservator, 4th grade, on deputation to the Marwar State.

7.—CENTRAL PROVINCES GAZETTE.

30th November 1898.—No. 42.—Leave without pay for two months, under Article 372 of the Civil Service Regulations, is granted to Rajendra Lal Shaw, Deputy Ranger, 2nd grade, Permanent Establishment, and Naib Daroga, Temporary Establishment, Jubbulpore Forest Division, in extension of the leave without pay granted him by Departmental Order No. 28, dated the 21st September 1898.

5th December 1898.—No. 43.—Privilege leave for seven days, under Article 291 of the Civil Service Regulations, was granted to Mr. W. J. Anthony, Forest Ranger, Permanent Establishment, Hoshangabad Forest Division, with effect from the 8th to the 14th November 1898, both dates inclusive.

8th December 1898.—No. 4354.—The Chief Commissioner is pleased to appoint Mr. W. G. Gilmore, Forest Ranger, 1st grade, at present on extraordinary leave, to be an Extra Assistant Conservator of Forests, 4th grade, with effect from the 13th September 1898, to fill an existing vacancy.

9th December 1898.—No. 44 —Jan Muhammad, Deputy Ranger, sub. *pro tem.*, is transferred from the Jubbulpore to the Damoh Forest Division.

14th December 1898 —No. 4416.—Privilege leave for three months, under Article 291 of the Civil Service Regulations, is granted to Mr. W. P. Thomas, Deputy Conservator of Forests, Central Provinces, with effect from the date on which he is relieved by Mr. Bagshawe of his duties of Officiating Conservator of Forests, Hyderabad Assigned Districts.

22nd December 1898.—No. 4548.—Mr. Narayan Parshad Bajpai, Extra-Assistant Conservator of Forests, 4th grade, attached to the Raipur Forest Division, is transferred to the charge of the Pranhita-Godavery Sub Division in the Chanda Forest Division.

No. 4550.—Furlough for two years, under Article 340 (b) of the Civil Service Regulations, is granted to Mr. F. O. Lemarchand, Deputy Conservator of Forests, Nagpur-Wardha Division, with effect from the 7th March 1899, or the subsequent date on which he may avail himself of it.

8.—BURMA GAZETTE.

17th November 1898.—No. 12.—With reference to Revenue Department Notification No. 335, dated the 20th October 1898, Mr. H. H. Forteach, Deputy Conservator of Forests, assumed charge of the Toungoo Working Plans division on the afternoon of the 15th November 1898,

18th November 1898.—No. 27.—With reference to Revenue Department Notification No. 356, dated the 14th November 1898, Mr C. R. Dun, Deputy Conservator of Forests, reported his arrival at Mandalay on the afternoon of the 18th instant and is deputed to special duty in the Northern Shan States.

22nd November 1898.—No. 18.—Mr. C. V. Ryan, Extra Assistant Conservator of Forests, reported his return from the two months' privilege leave granted him in Notification No. 283 (Forests), dated the 25th August 1898, on the forenoon of Saturday, the 5th instant.

25th November 1898.—No. 364.—Under the provisions of Articles 277 and 291 of the Civil Service Regulations, privilege leave for two months and 23 days is granted to Mr. T. W. Forster, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

29th November 1898—No. 365—Mr. Alexander Rodger, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 29th November 1898, before noon.

Mr. Rodger is posted to the head-quarters of the Tharrawaddy forest division.

29th November 1898.—No. 366.—Mr. Arthur Lawrence, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 29th November 1898, before noon.

Mr. Lawrence is posted to the head-quarters of the Mu forest division.

No. 367.—Mr. S. F. L. Cappel, Assistant Conservator of Forests, is transferred from Shwebo to the charge of the Toungoo subdivision.

29th November 1898.—No. 28.—Mr. W. H. Craddock, Extra Assistant Conservator of Forests, relinquished charge of his duties in the Pyinmana division on the afternoon of the 1st November 1898 and reported himself for duty at Taunggyi on the forenoon of the 10th November 1898.

1st December 1898—No. 24.—Mr. H. Calthrop, Deputy Conservator of Forests, was relieved of the charge of the Prome division on the afternoon of the 20th November 1898 by Mr. J. L. Heffernan, Extra Assistant Conservator of Forests.

2nd December 1898.—No. 29.—With reference to Revenue Department Notification No. 255, dated the 14th November 1898, Mr. A. H. M. Lawson, Assistant Conservator of Forests, reported his arrival at Mandalay on the afternoon of the 1st instant and is deputed to special girdling duty in the Bhamo division.

3rd December 1898.—No. 373.—Mr. A. Smythies, Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of furlough for one month.

5th December 1898.—No. 375—Mr. P. E. Plunkett, Extra Assistant Conservator of Forests, is posted to the charge of the Thaton range of the West Salween Forest division.

No. 376.—Mr W. J. Dalton, Extra Assistant Conservator of Forests, is posted to the charge of the Mezeik range of the Kado Forest division.

No. 377.—Mr. H. W. A. Watson, Assistant Conservator of Forests, is transferred from Shwegyin and posted to the Working Plans division, Toungoo

6th December 1898.—No. 25.—With reference to Revenue Department Notification No. 365 (Forests), dated the 29th November 1898, Mr. A. Rodger, Assistant Conservator of Forests, reported his arrival at Tharrawaddy on the afternoon of the 5th December 1898.

7th December 1898.—No. 379.—Mr. H. S. Ker-Edie, M.A., Assistant Conservator of Forests, reported his arrival in Rangoon on the 5th December 1898, before noon. Mr. Ker-Edie will be placed next above Mr. C. B. Smales in the Burma Provincial list.

Mr. Ker-Edie is posted to the charge of the Rangoon Forest division *vice* Mr. Perreé, transferred

9th December 1898.—No. 381.—Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, is transferred from the Eastern circle and appointed to the charge of the Prome Forest division.

9th December 1898.—No. 382.—Mr. S. E. F. Jenkins, Forest Ranger, is promoted to the 4th grade of Extra Assistant Conservators of Forests, with effect from the 1st November 1898.

Mr. Jenkins' position on the Provincial Forest list will be immediately below Mr. Dalton.

9th December 1898.—No. 24.—With reference to Revenue Department Notification No. 366, dated the 29th November 1898, Mr. Arthur Lawrence, Assistant Conservator of Forests, 2nd grade, assumed charge of his duties at the head-quarters of the Mu Forest division on the 7th December 1898, before noon.

9th December 1898.—No. 14.—On his return from the leave granted to him in Revenue Department Notification No. 257, dated the 5th August 1898, Mr. G. R. Long, Deputy Conservator of Forests, received charge of the West Salween division from Mr. A. Weston, Deputy Conservator.

9th December 1898.—No. 26.—Mr. W. F. Perreé, officiating Deputy Conservator of Forests, was relieved of the charge of the Rangoon division on the afternoon of the 8th December 1898, by Mr. H. S. Ker-Edie, officiating Deputy Conservator of Forests.

12th December 1898.—No. 30.—Mr. T. W. Forster, Extra Assistant Conservator of Forests, Pyinmana, availed himself of the two months' and 23 days' privilege leave granted him in Revenue Department Notification No. 364 (Forests), dated the 25th November 1898, on the forenoon of the 6th December 1898.

13th December 1898.—No. 386.—In supersession of the last sentence of this department Notification No. 253, dated the 3rd August 1898, Mr. G. Q. Corbett, Deputy Conservator of Forests, is permitted to overstay the privilege leave therein granted him by ten days.

18th December 1898.—No. 387.—Mr. W. H. Craddock, Extra Assistant Conservator of Forests, is transferred from Pyinmana to the Southern Shan States Forest division.

18th December 1898.—No. 388.—The following temporary alterations in rank are ordered in the Forest Department :—

- (1) With effect from the 12th September 1898, consequent on the departure on privilege leave of Mr. Hodgson, Deputy Conservator of Forests :

Mr. C. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to officiate as Deputy Conservator, 3rd grade.

- (2) With effect from the 30th September 1898, consequent on the return of Mr. C. M. Hodgson, Deputy Conservator of Forests, from privilege leave :

Mr. C. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

- (3) With effect from the 4th October 1898, consequent on the return from furlough of Mr. C. L. Toussaint, Deputy Conservator of Forests :

Mr. W. F. Perreé, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

14th December 1898.—No. 25.—With reference to Revenue Department Notification No. 367, dated the 29th November 1898, Mr S. E. F. Cappel, Assistant Conservator of Forests, relinquished charge of his duties in the Mu division on the 7th December 1898, before noon.

16th December 1898.—No. 27.—With reference to Notification No. 342 (Forests), dated the 31st October 1898, Mr. W. T. T. McHarg, Deputy Conservator of Forests, was relieved of his duties in the Pegu Forest division on the afternoon of the 12th December 1898, on transfer to the Eastern Circle.

19th December 1898.—No. 15.—With reference to Revenue Department Notification No. 367 (Forests), dated the 29th November 1898, Mr. S. F. L. Cappel, Assistant Conservator of Forests, reported his arrival at Toungoo on the morning of the 13th instant.

20th December 1898.—No. 28.—With reference to Revenue Department Notification No. 381 (Forests), dated the 9th December 1898, Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, received charge of the Prome division from Mr. J. L. Hefferman, Extra Assistant Conservator of Forests, on the forenoon of the 15th December 1898.

20th December 1898.—No. 265.—At the departmental examination held at Bassein, Akyab, Moulmein, Mergui, Minbu, Myingyan, Meiktila, Mandalay, Mogók, Myitkyina, Monywa, Kiudat, Taunggyi, Kengtūng, and Falam, on the 7th and 8th November 1898, the following candidates passed the examination in Burmese by the standards specified below :—

Higher Standard.

Mr. A. H. M. Lawson, Assistant Conservator of Forests.

Mr. G. K. Parker, Assistant Conservator of Forests.—*with great credit.*

Mr. R. S. Troup, Assistant Conservator of Forests.

Mr. G. T. Wrafter, Extra Assistant Conservator of Forests.

Mr. S. A. Wood, Extra Assistant Conservator of Forests.—*with credit.*

Mr. W. J. Dalton, Extra Assistant Conservator of Forests.

Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests.

Mr. G. Cooper Forest Ranger,

Mr. S. F. L. Cappel, Assistant Conservator of Forests.

Mr. J. J. Rorie, Assistant Conservator of Forests.

23rd December 1898.—No. 401.—Mr. C. W. Doveton, Assistant Conservator of Forests was placed on duty in the Yaw Forest Division, with effect from the date of his relief of the charge of the division by Mr. Grenfell.

This supersedes this department Notification No. 331, dated the 20th October 1898, placing Mr. Doveton on Working Plans duty.

9.—ASSAM GAZETTE.

23rd December 1898.—No. 9027G.—On the Report of the Central Examination Committee, the Chief Commissioner directs the publication, for general information, of the results of the Half-yearly Examination of Assistant Commissioners Extra-Assistant Commissioners and others, held on the 7th, 8th, 9th, 10th, and 11th November 1898.

Name.	Subjects taken up by Candidates		Subjects in which passed		Subjects in which still required to pass	
	Higher Standard	Lower Standard	Higher Standard	Lower Standard	Higher Standard.	Lower Standard.
1	2	3	4	5	6	7
<i>Forest Officers</i>						
Mr. J O Carroll, Assistant Conservator,	..	Bengali ..	..	..	Bengali .	Bengali ..
	Forest Law				Forest Law,	
<i>Forest Rangers.</i>						
Mr. W. Breakey ..	Land Revenue.*		" Procedure & Accounts."*			
Babu Basant Kumar	Procedure & Accounts.*					
G sw ml, ..	Land Revenue "					

23rd December 1898—No. 9029G —Mr. F H. Cavendish, Assistant Conservator of Forests, who has been appointed by Her Majesty's Secretary of State to the Forest Department in Assam, having reported his arrival in India, is attached to the Goalpara Forest Division.

24th December 1898.—No. 9104G.—The following Notification by the Government of India in the Revenue and Agricultural Department is published :

No 942F., dated Calcutta, the 13th December 1898.—The following transfers are ordered in the interests of the public service.

- (i) Mr. H. S Ker-Edie, Assistant Conservator of Forests, First Grade (Officiating Deputy Conservator, Fourth Grade), Assam—to Burma.
- (ii) Mr. W. F. Perreé, Assistant Conservator of Forests, First Grade (Officiating Deputy Conservator, Fourth Grade) Burma—to Assam.

24th December 1899 —No. 9106G.—The following Notification by the Government of India in the Revenue and Agricultural Department is republished :

EXTRACTS FROM OFFICIAL GAZETTES.

No. 945 F, dated Calcutta, the 18th December 1898—The following transfers are ordered in the interests of the public service :

- (i) Mr. T. J. Campbell, Deputy Conservator of Forests, Assam—to the North-Western Provinces and Oudh.
- (ii) Mr. W. A. R. Doxat, Assistant Conservator, North-Western Provinces and Oudh—to Assam.

10.—HYDERABAD RESIDENCY GAZETTE.

Nil

11.—MYSORE GAZETTE.

9th December 1898.—No. 7132—*Mis F.* 69-93.—Mr. P. E. Benson, Sub Assistant Conservator of Forests, on Plague duty, Bangalore, has passed a satisfactory examination in the Kanarese language.

17th December 1898.—No 4822.—*Fl. F.* 50-95.—Colonel J. Campbell-Walker, Conservator of Forests, in Mysore, is granted three months' privilege leave of absence, from the 2nd January 1899 or from such date as he may avail himself of the same, after the expiry of which he will retire from service.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1—GAZETTE OF INDIA.

6th January, 1899.—No. 18-F.—The undermentioned officers, who have been appointed by Her Majesty's Secretary of State to the Forest Department of India, are appointed to be Assistant Conservators of the 2nd grade, with effect from the dates specified opposite their names, and are posted to the provinces noted below :—

Mr. A. J. Gibson, Punjab, 18th November, 1898.

Mr. A. Rodger, Burma, 29th November, 1898.

Mr. A. P. Percival, Central Provinces, 18th November, 1898.

Mr. E. R. Stevens, Bengal, 24th November, 1898.

Mr. A. Lawrence, Burma, 29th November, 1898.

Mr. F. H. Cavendish, Assam, 24th November, 1898.

2—MADRAS GAZETTE.

16th December, 1898.—The three months' sick leave granted to Ranger Mr. E. A. Monisai, Nilgiri District, and published on page 1354 of Part II, *Fort St. George Gazette*, dated 18th October, 1898, is extended by two months.

4th January, 1899. No. 6.—Mr. S. C. Moss, Extra Assistant Conservator of Forests, Second grade, will be considered to have acted as District Forest Officer, Salem, from 16th July to 23rd September, 1898.

6th January, 1899.—Privilege leave.—To M. R. Ry. K. G. Subba Row, Ranger, Sixth grade, Salem district for two months, under article 291 of the Civil Service Regulations, from a date of relief.

11th January 1899.—*Extension of leave*—The six weeks' leave on medical certificate granted as per notification in *Fort St. George Gazette*, dated 29th November, 1898, Part II, page 1522, to Ranger K. Narayanaswami Iyer, North Coimbatore division, is extended by two weeks.

11th January, 1899.—*Transfers*—The following transfers are ordered :—

- (1) Acting Ranger M. R. Ry. C. Ramaswami Aiyangar from the Nellore district to the Cuddapah district. To join forthwith.
- (2). Ranger M. R. Ry. C. Rajahgopaul Naidu from the Cuddapah district to the Nellore district on relief by M. R. Ry. C. Ramaswami Aiyangar.
- (3). M. R. Ry. T. Narayanaswami Aiyar, Ranger, Fourth grade, from the Trichinopoly district to the South Canara district in the Southern Circle.
- (4). M. R. Ry. A. Srinivasa Chamberlain, Ranger, Sixth grade, from the Southern Circle to the Trichinopoly district in the Central Circle.

16th January, 1899.—*Leave*—M. R. Ry. A. Srinivasa Chamberlain, Forest Ranger, Sixth grade, South Canara, is granted sick leave on medical certificate under article 369 of the Civil Service Regulations for one month from 11th January, 1899.

Promotion.—The following promotion is ordered in the Southern Circle :—

Mr. H. O'Neill, Ranger, Second grade, First grade, permanent, with effect from 18th November, 1898.

30th January, 1899.—No. 40.—Appointment.

No.	Name and designation of officer.	District.	Nature of charge.	REMARKS.
1	Mr. J. S. Soot, Assistant Conservator of Forests, Cuddapah.	Nellore	..	To work under the orders of the Collector as a temporary measure.

31st January, 1899.—No. 43.—Posting.

No.	Name of officer	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	M. R. Ry. C. M Maduranayagam Pillai A argal.	Forest Ranger, 1st grade, Central Circle.	Extra Assistant Conservator of Forests, 4th Grade	Permanent	In the vacancy caused by the conversion of the Forest Assistant's post in the Board's Office into an Extra Assistant Conservatorship, fourth grade—vide G. O., No. 358, Revenue, dated 27th June 1898, and para. 4 of the Government of India's letter communicated in G. O., No 710, Revenue, dated 24th November 1893.

31st January, 1899.—No. 89—Mr. A. W. Lushington, Deputy Conservator of Forests, Kurnool district, is granted furlough for one year, three months and nine days under article 310 (b) of the Civil Service Regulations.

31st January, 1899.—No. 44 —Posting.

No.	Name and designation of officer	District.	Nature of charge.	Remarks.
	Mr. H. F Arbuthnot, Assistant Conservator of Forests.	North Coimbatore.		To work under the orders the District Forest Officer.

3.—BOMBAY GAZETTE.

4th January, 1899.—No. 6.—His Excellency the Governor in Council is pleased to appoint Mr. R. Madan, L. C. E. (Bom.), to hold charge of the office of Divisional Forest Officer, West Khandesh, in addition to his own duties, pending further orders.

No. 7.—His Excellency the Governor in Council is pleased to appoint Mr. J. H. Clabby, on return to duty, to be Divisional Forest Officer, Dharwar.

6th January, 1899.—No. 2365 —Messrs. C. G. Dalia, Extra Assistant Conservator of Forests and E. M. Hodgson, Assistant Conservator of Forests, respectively delivered over and received charge of the Sub-Division Forest Office, Surat, on the afternoon of the 19th December 1898.

9th January, 1899 —No. 4743.—Rao Bahadur Sitaram Damodar, District Deputy Collector, Khandesh, C. D., received charge of the West Khandesh Divisional Forest Office from Mr. J. H. Clabby, Extra Assistant Conservator of Forests, on the afternoon of 9th December 1898, and delivered over the same to Mr. R. H. Madan, Extra Deputy Conservator of Forests, on the forenoon of 16th December 1898.

17th January, 1899.—No. 4858 —Messrs. R. H. Madan, Extra Deputy Conservator, and J. H. Clabby, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office, West Khandesh, on the forenoon of 3rd January 1899.

17th January, 1899.—No. 6811 —Mr. D. A. Thomson, acting Deputy Conservator, delivered over, and Mr. B. G. Deshpande, Extra Assistant Conservator, received charge of the Kolaba Sub-Division on the afternoon of the 21st day of December 1898.

19th January, 1899 —No. 425 —Mr. Chunilal Gulabchand Dalia, L. C. E., Extra Assistant Conservator of Forests, third grade, and Sub Divisional Forest Officer, Surat, is allowed privilege leave of absence for three months.

19th January, 1899.—No. 7177 —Mr. H. A. Nadkerni, Extra Assistant Conservator, received charge of the Sub-division Forest office, S. D., Kanara, from Mr. H. Murray, Deputy Conservator and Divisional Forest Officer, S. D., Kanara, on the afternoon of the 14th instant.

30th January, 1899.—No. 4904.—Messrs. J. H. Clabby, Extra Assistant Conservator of Forests, and R. H. Madan, Extra Deputy Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office, West Khandesh, on 12th January 1899, in the afternoon.

31st January, 1899 —No. 6983—Mr. B. G. Deshpande, Extra Assistant Conservator of Forests, is allowed privilege leave of absence for thirty days from the 9th November, 1898.

Mr. E. M. Hodgson, Divisional Forest Officer, Surat, passed an examination in Gujarati according to the Higher Standard on the 7th January 1899.

4.—BENGAL GAZETTE.

3rd January, 1899.—No. 48A.—The report of the Central Examination Committee having been received, the result of the half-yearly

departmental examination of Assistant Magistrates and others, held on the 17th, 18th, and 19th November 1898, is published for general information.

I.—SECOND OR HIGHER STANDARD.

V.

The following Forest Officers have passed in the subject or subjects mentioned opposite their names :—

1. Babu Guru Das Chatterji Forest Law, and Procedure and Accounts
2. Mr. P. J. Draper Forest Law, and Land Revenue Systems
3. „ J. P. Gregson Procedure and Accounts
4. „ E. E. Slane Urdu by both Standards.

6th January, 1899.—No. 59F—Mr. C. G. Rogers, F.C.S., Deputy Conservator of Forests, 4th grade, is promoted to officiate in the 3rd grade of Deputy Conservator of Forests, with effect from the 27th November 1898, from which date the following reversions are ordered :—

Mr. H. H. Haines, F.C.S., Deputy Conservator of Forests, 4th, and officiating 3rd grade, to revert to the 4th grade of Deputy Conservator of Forests.

Mr. E. P. Stebbing, Assistant Conservator of Forests, 2nd grade, and officiating Deputy Conservator, 4th grade, to revert to his post of Officiating Assistant Conservator, 1st grade.

5.—N.-W. P. AND OUDH GAZETTE.

11th January, 1899,—No. $\frac{90}{11-31C}$ —Pandit Rama Dat, Extra Assistant Conservator of Forests (*sub pro tem.*) attached to the Janusar Forest Division of the School Circle, privilege leave for two months and ten days,

20th January, 1899—No. $\frac{152}{11-665H}$ —With effect from the 22nd October 1898, the date on which Mr E. McA Moir, Deputy Conservator of Forests 1st grade retired from the service.

Mr. N. Hearle, Deputy Conservator of Forests, from the 2nd to the 1st grade but to officiate as Conservator of Forests, 3rd grade.

Mr. A. G. Hobart-Hampden, Deputy Conservator of Forests, 2nd grade, *Provisionally substantive* on full length), to be confirmed in that grade.

Mr B. A. Hebsch, Deputy Conservator of Forests, 3rd grade, to be Deputy Conservator of Forests, 2nd grade, *Provisionally sub-*

stantive, but to continue to officiate as Deputy Conservator of Forests, 1st grade.

20th January, 1899.—No. $\frac{153}{11-865B}$.—Mr. T. J. Campbell, Deputy Conservator of Forests, 4th grade, Assam, whose services have been placed at the disposal of this Government, to be Deputy Conservator of Forests, 3rd grade, with effect from the 9th January 1899.

6.—PUNJAB GAZETTE.

30th January, 1899.—No. $\frac{43}{A L N o 1}$.—Transfer.—Mr. A. J. Gibson, Assistant Conservator of Forests, attached to the Lahore Forest Division, has been attached to the Kangra Forest Division with effect from the afternoon of the 12th January 1899.

30th January 1899.—No. $\frac{16}{A L N 2}$.—Messrs. W. Mayes, Officiating Deputy Conservator of Forests, and H. A. Houghton, Deputy Conservator of Forests respectively made over and received charge of the Rawalpindi Forest Division on the forenoon of the 19th January 1899, consequent on the latter's return from the privilege leave granted to him *vide* Punjab Government Notification No. $\frac{434}{A L N o 22}$, dated 28th October last.

Mr. W. Mayes remains attached to the Rawalpindi Forest Division.

7.—CENTRAL PROVINCES GAZETTE.

10th December, 1898.—No. 45.—Privilege leave for seventeen days, under article 291 of the Civil Service Regulations, is granted to Mr. S. R. Parsons, Ranger, Permanent Establishment, Nimar Forest Division, with effect from the 24th December 1898.

28th December, 1898.—No. 46.—Privilege leave for ten days, under article 291 of the Civil Service Regulations, was granted to P. Shankarnath, Forest Ranger, Permanent Establishment, Damoh Forest Division with effect from the 15th to the 24th November 1898, both dates inclusive.

17th January, 1899.—No. 5.—The following changes will take place in the list of Rangers in the Central Provinces, with effect from the 18th September 1898, consequent on the appointment of Mr. W. G. Gilmore as Extra-Assistant Conservator of Forests, 4th grade:—

A. Lonnuwamy, Forest Ranger, 1st grade, sub. *pro tem.*, to be Forest Ranger 1st grade, substantive.

Dhanjishah N. Avastia, Forest Ranger, 2nd grade, sub. *pro tem.*, to be Forest Ranger, 2nd grade, substantive.

Mr. F. J. Langhorne, Forest Ranger, 3rd grade, sub. *pro tem.*, to be Forest Ranger, 3rd grade, substantive.

Ganshyam Parshad, Forest Ranger, 4th grade, sub. *pro tem.*, to be Forest Ranger, 4th grade, substantive.

Muhammed Saheb, Forest Ranger 5th grade, to be Forest Ranger, 5th grade, substantive, *vice* Ganshyam Parshad promoted.

19th January, 1899.—No. 233.—The privilege leave for three months granted to Mr. H. E. Bartlett, Assistant Conservator of Forests, in charge of the Damoh Forest Division, by Order No. 2674, dated the 28th July 1898, has been commuted by Her Majesty's Secretary of State for India into leave on medical certificate and extended by two months.

19th January, 1899.—No. 238.—The privilege leave for three months granted to Mr. W. P. Thomas, Deputy Conservator of Forests, Central Provinces, by Order No. 4446 dated the 14th ultimo, is commuted to furlough for one year, under article 340 (b) of the Civil Service Regulations.

19th January, 1899.—No. 292.—Mr. A. M. Long, Assistant Conservator of Forests, has been granted by Her Majesty's Secretary of State for India a still further extension of two months' leave on medical certificate in extension of the furlough granted him by the Assam Administration by the following Notifications published in the Assam Gazette :—

No. 1420-G., dated the 26th February 1897,

No. 5850-G. dated the 18th August 1897.

No. 7409 G., dated the 11th October 1897.

24th January, 1899.—No. 316.—On return from the leave on medical certificate granted him by Order No. 233 dated the 19th instant, Mr. H. E. Bartlett, Assistant Conservator of Forests is posted to the charge of the Narsinghpur Forest Division *vice* Mr. Muhammad Kadir Bakhsh, Extra-Assistant Conservator of Forests, deceased.

8.—BURMA GAZETTE.

4th January, 1899.—No. 5.—The following temporary alterations in rank are ordered in the Forest Department :—

- (1) With effect from the 15th November 1898, consequent on the return from privilege leave of Mr. G. Q. Corbett, Deputy Conservator 3rd (officiating 2nd) grade :

Mr. H. Jackson, Deputy Conservator 3rd (officiating 2nd) grade, to revert to his substantive appointment.

Mr. F. Linnel, Deputy Conservator, 4th grade provisionally substantive officiating Deputy Conservator, 3rd grade, to revert to his substantive appointment.

- (2) With effect from the 16th November 1898, consequent on the return from privilege leave of Mr. H. H. Forteach, Deputy Conservator, 4th (officiating 3rd) grade :

Mr. A. M. Burn-Murdoch, Deputy Conservator, 4th grade, provisionally substantive, officiating Deputy Conservator, 3rd grade, on privilege leave, to revert to his substantive appointment.

Mr. S. Carr, Deputy Conservator, 4th grade, provisionally substantive, officiating Deputy Conservator, 3rd grade, to revert to his substantive appointment.

- (3) With effect from the 21st November 1898 the date on which Mr. H. Calthrop, Deputy Conservator, 2nd grade, relinquished charge of the Prome division :

Mr. H. Jackson, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. C. R. Dun, Deputy Conservator, 4th grade, to officiate as Deputy Conservator 3rd grade.

- (4.) With effect from the 2nd December 1898, consequent on the return from privilege leave of Mr. G. R. Long, Deputy Conservator, 4th officiating 3rd) grade :

Mr. C. R. Dun, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment.

5th January, 1899.—No. 6.—Mr. J. J. Rorie, Assistant Conservator of Forests, is transferred from the Western Circle and appointed Personal Assistant to the Conservators of Forests, Eastern and Western Circles, and to the charge of the Direction Divisions, Eastern and Western Circles.

9th January, 1899.—No. 1.—With reference to Revenue Department Notification No. 6, dated the 5th January 1899, Mr. J. J. Rorie, Assistant Conservator of Forests, relinquished charge of his duties in the Yaw division on the afternoon of the 26th November 1898, and assumed charge of his duties as Personal Assistant to the Conservators of Forests, Eastern and Western Circles, on the 5th December 1898, before noon.

10th January, 1899.—No. 1.—Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests, is appointed to the charge of the Gangaw Sub-division, of the Yaw Forest division.

10th January, 1899.—No. 1.—With reference to Revenue Department Notification No. 6 (Forests), dated the 5th January 1899, Mr. J. J. Rorie, Assistant Conservator of Forests, received charge of the Direction Division, Eastern Circle, from Lieutenant-Colonel C. T. Bingham, Conservator of Forests, on the afternoon of the 3rd January 1899.

11th January, 1899.—No. 1.—With reference to Revenue Department Notification No. 377 (Forests), dated the 5th December 1898, Mr. H. W. A. Watson, Assistant Conservator of Forests, reported his arrival at Toungoo on the forenoon of the 20th December 1898.

11th January 1899.—No. 14.—Under the provisions of article 340 (b) (2) of the Civil Service Regulations, furlough for one year is granted to Mr. H. Calthrop, Deputy Conservator of Forests, with effect from the date on which he availed himself of it.

Under the provisions of article 354 (b) of the Civil Service Regulations, the Lieutenant-Governor directs that the furlough granted to Mr. Calthrop in this notification shall begin in India at the end of his subsidiary leave without forfeiture of his subsidiary leave.

11th January, 1899.—No. 5.—At the departmental examination held at Rangoon, Bassein, Moulmein, Myingyan, Mandalay and Myitkyina on the 7th and 8th November 1898 the following officers passed in the subjects specified below according to the standard prescribed for the examination of Forest Officers :—

Law.

Mr. R. S. Treup, Assistant Conservator of Forests.

Mr. S. F. L. Cappel, Assistant Conservator of Forests.

Mr. J. J. Rorie, Assistant Conservator of Forests.

Maung Aung Ban, Forest Ranger.

Maung Tha Ka Do, Extra Assistant Conservator of Forests.*Revenue.*

Mr. R. S. Troup, Assistant Conservator of Forests.

Mr. H. W. A. Watson, Assistant Conservator of Forests.

Mr. J. J. Rorie, Assistant Conservator of Forests.

Mr. C. E. Allen, Extra Assistant Conservator of Forests.

Mr. S. A. Wood, Extra Assistant Conservator of Forests.

Mr. W. R. French, Forest Ranger.

Procedure and Accounts.

Maung Aung Ban, Forest Ranger.

Mr. H. McL. Carson, Forest Ranger.

12th January, 1899.—No. 2.—Under article 370 of the Civil Service Regulations leave for six months on medical certificate, is granted to Mr. W. R. French, Forest Ranger, 3rd grade, Katha division, with effect from the 6th December 1898.

13th January, 1899.—No. 16.—Mr. W. T. T. McHarg, Deputy Conservator of Forests, is transferred from Pegu and is appointed to the charge of No. II Working Plans Party, in the Eastern Circle with headquarters at Pyinmana, as a temporary measure.

This Notification cancels this department Notification No. 342, dated the 31st October 1898.

No. 17.—Mr. C. W. Doveton, Assistant Conservator of Forests, is transferred from Pakokku to the charge of Working Plans Party, No. II, in the Eastern Circle, with headquarters at Pyinmana.

No. 18.—On relief by Mr. Doveton, Mr. W. T. T. McHarg, Deputy Conservator of Forests, is posted to duty in the Eastern circle.

No. 19.—Mr. C. W. Allan, Extra Deputy Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to spend the remainder of his leave in India.

No. 20.—With reference to this department Notification No. 381, dated the 9th December 1898, it is notified that, prior to his transfer to Prome, Mr. A. M. Burn Murdoch, Deputy Conservator of Forests, was transferred from Bhamo to the charge of No. II Working Plans Party at Pyinmana as a temporary measure.

18th January, 1899.—No. 21.—Under the provisions of article 291 of the Civil Service Regulations, privilege leave for three months is granted to Mr. E. B. Powell, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

16th January, 1899.—No. 1.—With reference to Revenue Department Notification No. 6, dated the 5th January 1899, Mr. J. J. Rorie, Assistant Conservator of Forests, received charge of the Direction Division, Western Circle, on the afternoon of the 14th January 1899.

25th January, 1899.—No. 42.—Mr. J. Nisbet, Deputy Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of furlough for 26 days.

9.—ASSAM GAZETTE.

4th January 1899.—No. 31 G.—Mr. W. F. Perreé, Officiating Deputy Conservator of Forests, who was transferred to Assam by

Revenue and Agricultural Department Notification No. 943F., dated the 18th December 1898, is placed in charge of the Jolpara Forest Division, holding at the same time charge of the Garo Hills Forest Division, with effect from the date on which he takes over charge.

4th January, 1899.—No. 36G.—Mr A. R. Dicks, Officiating Assistant Conservator of Forests, First grade, attached for duty to the Sibesar Forest Division, is appointed to have charge of that division, with effect from the date on which he takes over charge from Mr. H. G. Young, Deputy Conservator of Forests.

4th January, 1899.—No. 37G.—Mr. W. A. R. Doxat, Assistant Conservator of Forests, who was transferred to Assam by Revenue and Agricultural Department Notification No. 945F., dated the 18th December 1898, is placed in charge of the Kamrup Forest Division, with effect from the date on which he takes over charge of the division from Bahu Tara Kisor Gupta, Extra Assistant Conservator of Forests.

8th January, 1899.—No. 374G.—Mr A. R. Dicks, Assistant Conservator of Forests, attached to the Sibesar Forest Division, is placed temporarily on special duty in connection with the experimental tappings of rubber trees in the Chauliar plantation in the Darrang Forest Division, before he takes over charge of Sibesar Division from Mr. H. G. Young, Deputy Conservator of Forests, as directed in the Chief Commissioner's Notification No. 36G., dated the 4th January 1899, published at page 2, Part I, of the Assam Gazette of the 7th January 1899.

10.—HYDRABAD RESIDENCY GAZETTE.

Nil

11.—MYSORE GAZETTE.

6th January, 1899.—No. 4586.—*Pt. F.* 12-98.—Col. I Campbell Walker, delivered over, and Mr. J. L. Pigot received, charge of the office of the Conservator of Forests in Mysore on the forenoon of the 8th January 1899.

31st January, 1899.—No. *Pg.* 1071.—Under article 173 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests on plague duty at Bangalore, was granted eleven days' casual leave of absence, with effect from the 16th November 1898.

31st January, 1899.—No. *Pg.* 1075.—Under article 171 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests on plague duty, Bangalore City, was granted casual leave of absence for five days from 1st to 5th January 1899.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

24th February 1899.—No. 228-F.—On return from the furlough granted him in the Notification of this Department, No. 285F., dated the 19th April, 1898, Mr. A. Smythies, Conservator, 3rd grade, resumed charge in the afternoon of the 21st January, 1899, of the Western Forest Circle, Upper Burma, from Mr. H. C. Hill, Conservator, 1st grade, who then proceeded to relieve Mr. J. S. Gamble of the charge of the School Circle in the North-Western Provinces and Oudh.

24th February 1899.—No. 231-F.—On return from the furlough granted him in the Notification of this Department, No. 278-F., dated the 19th April, 1898, Mr. A. E. Wild, Conservator of Forests, 2nd grade, resumed charge of the Bengal Forest Circle from Mr. E. G. Chester, Officiating Conservator, 3rd grade, on the forenoon of the 10th February, 1899.

From the same date Mr. E. G. Chester, Officiating Conservator, reverted to his substantive appointment of Deputy Conservator, 1st grade, Bengal.

2.—MADRAS GAZETTE.

26th January 1899.—Promotion.—Mr. H. J. McLaughlin, Forest Ranger, 2nd grade, is promoted to Forest Ranger, 1st grade, with effect from 18th November 1898.

1st February 1899.—Privilege leave.—To M. R. Ry. N. Arumuga Mudaliar, Ranger, 3rd grade, Chingleput district, for one month and twenty days, from or after 5th March 1899, under article 291 of the Civil Service Regulations.

1st February 1899.—Erratum.—In notification published on page 100, in Part II of *Fort St George Gazette* dated 24th January, 1899, granting one month's sick leave on medical certificate to Ranger M. R. Ry. A. Srinivasa Chamberlain, for '11th January, 1899,' read '4th January, 1899.'

2nd February 1899.—Transfer.—S. V. Venkatramana Iyer, sub. *pro tem.*, Ranger, 6th grade, is transferred from South Coimbatore to South Canara. To join forthwith.

8th February 1899.—Leave.—M. R. Ry. T. Narayanaswami Iyer, Ranger, 4th grade, now under orders of transfer to South Canara, is granted privilege leave on medical certificate under article 291 of the Civil Service Regulations for three months from date of relief in Trinopoly.

9th February 1899.—*Departmental Test*—At the departmental examination held on the 30th January, 1899, the following Subordinates passed in the subjects specified opposite their names :—

Name.	Designation.	Subjects in which passed.
J. Krishnaswami Raja	Forester, 1st grade, Nellore district	Forest Act and Rules and Procedure and Accounts
T. R. Chengalvaraya Mudaliar	Do. 2nd grade, sub. <i>pro tem.</i> , Cuddapah district.	Forest Act and Rules only.
D. S. Raghavandra Row ...	Do. 2nd grade, sub. <i>pro tem.</i> , Chingleput	Office Procedure and Accounts only.
O. Vekataramana Aiyar	Do. 3rd grade, sub. <i>pro tem.</i> , Chingleput district	Forest Act and Rules and Procedure and Accounts.
S. Subramania Aiyar	Do. 3rd grade, sub. <i>pro tem.</i> , Salem district	Forest Act and Rules only.
G. Doraiswami Naidu	Do. Do. Do.	Forest Act and Rules and Procedure and Accounts.
R. V. Dasa Aiyar	Forest Range Clerk, Salem district	Do. Do. Do.
C. P. Garudaeshella Mudaliar	Forester, 3rd grade, sub. <i>pro tem.</i> , Salem district	Forest Act and Rules only.
V. Ramachandra Aiyer	Forest Range Clerk, Salem district	Office Procedure and Accounts only.
K. Desikaohari	Forester, 3rd grade Do.	Forest Act and Rules and Procedure and Accounts.
T. N. Seshagiri Row	Forest Range Clerk Do.	Do. Do.
T. V. Michel Pillai ...	Forester, 2nd grade, Tanjore district	Do. Do.
V. Namasivayam Pillai	Do. 3rd grade Do.	Do. Do.
C. Sundarrajan ...	Do. 3rd grade, sub. <i>pro tem.</i> , Salem district.	Do. Do.

11th February, 1899.—No. 59.—Mr. W. Carroll, Extra Assistant Conservator of Forests, 1st grade, will be considered to have acted as District Forest Officer, North Arcot, from 4th to 18th December 1898, both days inclusive.

14th February, 1899.—*Leave*.—To M. R. Ry. C. Rajahgopaul Naidu, Ranger, 5th grade, Cuddapah district (under transfer to the Nellore district) for one month under article 869 of the Civil Service Regulations from 1st February 1899.

18th February, 1899.—*Departmental Examination*—The following candidates have passed the Departmental Examination held on 23rd January 1899, in the subjects noted against their names :—

1. P. Annappa	Forest Act and Rules, Code and Accounts.
2. J. M. Wesley	Do. Do.
3. P. Narasinga Row	Do. Do.
4. K. V. Natesa Iyer	Do. Do.
5. R. P. Jeevappa Naick	Do. Do.
6. Pitchayya	Forest Act and Rules.
7. Sundresa Iyer	Do.
8. G. K. Chithambara Iyer	Do.
9. R. S. Rajagopala Iyengar.	Do.

20th February, 1899.—Transfers.—The following transfers are ordered :—

M. R. Ry. A. P. Ramachendra Mudaliar, Ranger, 4th grade, from the Chingleput district to the Trichinopoly district. To join forthwith.

M. R. Ry. T. Subbarayulu Naidu, Ranger, 5th grade, from the Trichinopoly district to the Chingleput district on relief by M. R. Ry. A. P. Ramachendra Mudaliar.

21st February, 1899.—No. 72

No.	Name of officer.	District.	Nature of charge.	REMARKS.
1	Mr. J. S. Battie ...	Kurnool	Acting District Forest officer.	During the absence of Mr. A. W. Lushington on furlough, or until further orders.

22nd February 1899 —Privilege leave.—To M. R. Ry. K. R. Manikka Mudaliar, Acting Ranger, 6th grade, Salem district, under article 291 of the Civil Service Regulations, for one month and twenty-two days from 31st October 1898.

22nd February 1899.—Departmental test.—The following subordinates have passed the Departmental Test, in the parts noted against each, of section 69 of the Revised Forest Code at the examination held in January, 1899 :—

Districts.	Name and designation.	In Parts (a) or (b).
The Nilgiris ...	T. M. Iyaccannu Pillai, Forester, II	Part (b), Forest Act and Rules only.
North Coimbatore	S. Muthusawmi Pillai, Forester II.	Parts (a) and (b) Forest Act and Rules and Procedure and Accounts.

24th February 1899.—No. 87.—Under article 344 (a) of the Civil Service Regulations, Mr. G. Hadfield, Deputy Conservator of Forests, Madras, is granted leave on medical certificate for one year, in extension of the furlough for two years already granted to him.

3.—BOMBAY GAZETTE.

20th February 1899.—No. 7814.—Messrs. W. E. Copleston and E. G. Oliver, acting Deputy Conservators of Forests, respectively delivered over and received charge of the Northern Division, Kánara, on the forenoon of the 6th instant.

Mr. W. E. Copleston, acting Deputy Conservator of Forests, received charge of the Working Plans Division, Southern Circle, from Mr. N. D. Satarawalla, Extra Assistant, on the afternoon of the 7th instant.

4.—BENGAL GAZETTE.

N^o

5.—N.-W. P. AND OUDH GAZETTE.

9th February 1899.—No. $\frac{821}{11-310}$ Pandit Rama Datt, Extra Assistant Conservator of Forests, who has been recalled from leave, to the charge of the Jaunsar Forest Division of the School Circle.

15th February 1899.—No. $\frac{877}{11-3930}$ Mr. N. Hearle, Deputy Conservator of Forests, on return from leave, to the charge of the Gonda Forest Division of the Oudh Circle.

16th February 1899.—No. $\frac{408}{11-36A}$ The following temporary promotions and reversions among Forest Officers are notified for general information :—

Entry No.	With effect from.	Consequent on.	Name.	From.	To.
1	18th September 1898	Mr. R. C. Milward's departure on privilege leave.	Mr. W. A. R. Doxat.	Officiating Assistant Conservator, 1st grade.	Officiating Deputy Conservator, 4th grade.
2	18th October 1898	Mr. R. C. Milward's return from privilege leave	Mr. W. A. R. Doxat.	Officiating Deputy Conservator, 4th grade.	Officiating Assistant Conservator, 1st grade.
3	28th October 1898	Mr. H. G. Billson's return from privilege leave.	Mr. F. F. R. Channer.	Officiating Deputy Conservator, 4th grade.	Officiating Assistant Conservator, 1st grade.
4	15th November 1898	Mr. W. Shakespear's return from privilege leave.	Mr. L. Maroer.	Officiating Deputy Conservator, 1st grade.	Officiating Deputy Conservator, 2nd grade.
			Mr. P. H. Clutterbuck.	Officiating Deputy Conservator, 2nd grade.	Officiating Deputy Conservator, 3rd grade.
			Mr. F. A. Leste.	Officiating Deputy Conservator, 3rd grade.	Officiating Deputy Conservator, 4th grade.
			Mr. R. C. Milward.	Officiating Deputy Conservator, 4th grade.	Officiating Assistant Conservator, 1st grade.

Entry No.	With effect from.	Consequent on	Name.	From.	To.
5	24th January 1899.	Mr. T. J. Campbell's appointment as Deputy Conservator, 3rd grade, in these Provinces	Mr. T. J. Campbell. Mr. B. B. Osmaston. Mr. W. H. Lovegrove. Mr. H. G. Billson. Mr. W. A. R. Doxat	Deputy Conservator, 3rd grade. Officiating Deputy Conservator, 2nd grade. Officiating Deputy Conservator, 3rd grade. Officiating Deputy Conservator, 4th grade. Officiating Assistant Conservator, 1st grade	Officiating Deputy Conservator, 2nd grade. Officiating Deputy Conservator, 3rd grade. Deputy Conservator, 4th grade. Assistant Conservator, 1st grade. Assistant Conservator, 2nd grade.

17th February 1899.—No. $\frac{441}{11-2228}$ The undermentioned officer has been granted by Her Majesty's Secretary of State for India, extension of leave :—

Name.	Service.	Appointment.	Period and nature of leave.
Mr. J. W. Oliver	Forest	Conservator of Forests, N.-W. P. and Oudh.	Furlough up to 1st July 1899.

18th February 1899.—No. $\frac{578}{11-2230}$ Mr. F. F. R. Ohanner, Assistant Conservator of Forests, in charge of the Gonda Forest Division of the Oudh Circle, to be attached to the Garhwal Forest Division of the Central Circle.

6.—PUNJAB GAZETTE.

1st February 1899.—No. $\frac{L. No. 5}{11-2230}$ —Mr. C. P. Fisher, Deputy Conservator of Forests, on return from furlough landed at Bombay on the forenoon of the 30th December 1898, and was attached to the Simla Forest Division, from the afternoon of the 8th January 1899.

He took over charge of that Division on the afternoon of the 17th January 1899, relieving Mr. E. M. Coventry, Deputy Conservator of Forests, proceeding to Europe on one year's furlough.

4th February 1899.—No. 66.—*Leave*.—Bhái Sádhu Singh, Extra Assistant Conservator of Forests, attached to the Chamba Forest Division, has been granted one month's privilege leave, with effect from the forenoon of the 17th January 1899.

4th February 1899.—No. $\frac{69}{A. L. No. 4}$.—Messrs. R. S. Hole and D. O. Witt, Assistant Conservators, 2nd grade, having passed in all subjects prescribed by Section 72 of the Forest Departmental Code, are promoted to Officiating Assistant Conservators, 1st grade, with effect from November 2nd, 1898, the date on which they completed their examinations.

8th February 1899.—No. $\frac{77}{A. L. No. 5}$.—*Erratum*.—In Notification No. $\frac{888}{A. L. No. 18}$, dated 23rd September 1898, opposite Mr. S. L. Kenny, read "Officiating Assistant Conservator" instead of "Provisional Assistant Conservator."

8th February 1899.—No. $\frac{78}{A. L. No. 6}$.—*Erratum*.—In Notification No. $\frac{847}{A. L. No. 16}$, dated 22nd August 1898, read "Officiating Assistant Conservator" instead of "Provisional Assistant Conservator."

10th February 1899.—No. $\frac{83}{A. L. No. 7}$.—The following Notification is issued in supersession of Notification No. $\frac{A. L. No. 14}{A. L. No. 14}$ dated 17th August 1898, which is hereby cancelled :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. A. St. V. Beechey	Assistant Conservator, 1st grade.	Offg. Deputy Conservator, 4th grade.	21st March 1898.	Consequent on the transfer of Mr. F. Linnell to Burma.
Mr. C. M. McOrle	Offg. Deputy Conservator, 4th grade.	Provisional Assistant Conservator, 1st grade.	6th May 1898.	Consequent on the return of Mr. A. M. F. Caccia from privilege leave.
Mr. E. M. Coventry	Offg. Deputy Conservator, 4th grade.	Sub. <i>pro. tem.</i> Deputy Conservator, 4th grade.	6th May 1898.	Consequent on the temporary transfer of Mr. A. M. F. Caccia to the North-Western Provinces.
Mr. C. M. McOrle.	Provisional Assistant Conservator, 1st grade.	Offg. Deputy Conservator, 4th grade.	Ditto.	
Mr. S. L. Kenny.	Offg. Assistant Conservator, 1st grade.	Sub. <i>pro. tem.</i> Assistant Conservator, 1st grade.	Ditto.	
Mr. W. Mayes.	Offg. Assistant Conservator, 1st grade.	Offg. Deputy Conservator, 4th grade.	21st May 1898.	Consequent on the departure of Mr. A. W. Blunt on privilege leave.

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. A. E. Lowrie.	Provisional Deputy Conservator, 3rd grade.	Deputy Conservator, 3rd grade.	24th May 1898.	Consequent on the retirement of Mr. F. C. Hicks from the service.
Mr. G. S. Hart.	Offg. Deputy Conservator, 3rd grade.	Provisional Deputy Conservator, 3rd grade.	Do.	
Mr. C. Somers Smith.	Provisional Deputy Conservator, 4th grade.	Deputy Conservator, 4th grade.	Do.	
Mr. A. W. Blunt.	Deputy Conservator, 4th grade.	Offg. Deputy Conservator, 3rd grade.	Do.	
Mr. E. M. Conventry.	Deputy Conservator, 4th grade, sub. <i>pro tem.</i>	Provisional Deputy Conservator, 4th grade, and Offg. Deputy Conservator, 3rd grade.	Do.	
Mr. C. M. McCrie.	Provisional Assistant Conservator, 1st grade, and Offg. Deputy Conservator, 4th grade.	Assistant Conservator, 1st grade, and Offg. Deputy Conservator, 4th grade.	Do.	
Mr. W. Mayes.	Offg. Assistant Conservator, 1st grade, and Offg. Deputy Conservator, 4th grade.	Provisional Assistant Conservator, 1st grade, and Offg. Deputy Conservator, 4th grade.	Do. Do.	
Mr. S. L. Kenny.	Assistant Conservator, 1st grade, sub. <i>pro tem.</i>	Offg. Deputy Conservator, 4th grade.		
Mr. R. M. Williamson	Offg. Deputy Conservator, 4th grade.	Offg. Deputy Conservator, 3rd grade.	19th June 1898.	Consequent on the departure of Mr. A. V. Menro on privilege leave.
Mr. H. E. Bartlett	Offg. Assistant Conservator, 1st grade.	Offg. Deputy Conservator, 4th grade.	Do.	
Mr. R. M. Williamson	Offg. Deputy Conservator, 3rd grade.	Offg. Deputy Conservator, 4th grade.	5th July 1898.	Consequent on the return of Mr. A. V. Menro from privilege leave.
Mr. H. E. Bartlett	Offg. Deputy Conservator, 4th grade.	Offg. Assistant Conservator, 1st grade.	Do.	

27th February 1899—No. ¹⁰² A. L. No. 3.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified against each :—

Name.	Present grade.	Grade to which promoted or reverted	With effect from.	REMARKS.
Mr. A. M. Long.	Assistant Conservator, 1st grade.	Provisional Deputy Conservator, 4th grade.	22nd October 1898.	Consequent on Mr. A. M. F. Caccia being seconded owing to Mr. Mc. A. Moir's retirement.
Mr. S. L. Kenny.	Offg. Assistant Conservator, 1st grade.	Provisional Assistant Conservator, 1st grade	Ditto.	
Mr. A. E. Lowrie.	Deputy Conservator, 3rd grade.	Offg. Deputy Conservator, 2nd grade.	18th November 1898.	Consequent on the departure of Mr. H. A. Hoghton on three months' privilege leave.
Mr. E. M. Coventry.	Provisional Deputy Conservator, 4th grade.	Offg. Deputy Conservator, 3rd grade.	Ditto.	
Mr. R. S. Hole.	Offg. Assistant Conservator, 1st grade.	Offg. deputy Conservator, 4th grade.	Ditto.	
Mr. W. P. Thomas.	Offg. Conservator, 3rd grade	Deputy Conservator, 1st grade	18th December 1898.	Consequent on the return of Mr. C. Bagshaw from furlough.
Mr. E. A. Down ..	Offg. Deputy Conservator, 1st grade ..	Deputy Conservator, 2nd grade ..	Ditto.	
Mr. A. E. Lowrie ..	Offg. Deputy Conservator, 2nd grade .	Deputy Conservator, 3rd grade ..	Ditto.	
Mr. E. M. Coventry	Offg. Deputy Conservator, 3rd grade. ...	Provisional Deputy Conservator, 4th grade	Ditto.	
Mr. S. L. Kenny. ..	Offg. Deputy Conservator, 4th grade ..	Provisional Assistant Conservator, 1st grade ..	Ditto.	

7.—CENTRAL PROVINCES GAZETTE.

26th January 1899.—No. 47 —Privilege leave for 75 days under article 291 of the Civil Service Regulations, is granted to Bhab 'Rao, Deputy Ranger, Permanent Establishment, Saugor Forest Division, with effect from such date as he may be permitted to avail himself of it. "

14th February, 1899.—No. 48.—Privilege leave for two months, under article 291 of the Civil Service Regulations, is granted to Bhayañi, Forest Ranger, Permanent Establishment, Nimar Forest Division, with effect from the 1st March 1899, or such subsequent date as he may be permitted to avail himself of it.

8.—BURMA GAZETTE.

31st January 1899.—No. 1.—Mr. H. Calthrop, Deputy Conservator of Forests, availed himself on the 1st December 1898, of the furlough granted him in Revenue Department Notification No. 14 (Forests) dated the 11th January 1899.

1st February 1899.—No. 4.—Mr. T. W. Forster, Extra Assistant Conservator of Forests, returned from the leave granted him in Revenue Department Notification No. 364 (Forests), dated the 25th November 1898, on the afternoon of the 5th January 1899.

1st February 1899.—No. 5.—Mr. R. O. A. Pinder, Forest Ranger, made over, and Mr. T. W. Forster, Extra Assistant Conservator of Forests, received, charge of the Pyinmana Revenue Range, in the Pyinmana Forest Division, on the afternoon of the 5th January 1899.

1st February 1899.—No. 6.—With reference to Revenue Department Notification No. 20 (Forests), dated the 18th January 1899, Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, relinquished charge of his duties as Special Girdling Officer, in the Bhamo Division, on the afternoon of the 26th November 1898, and assumed charge of the No. II Working Plans Party at Pyinmana on the forenoon of the 2nd December 1898.

1st February 1899.—No. 7.—With reference to Revenue Department Notification No. 381 (Forests), dated the 9th December 1898, Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, relinquished charge of his duties of the No. II Working Plans Party at Pyinmana on the afternoon of the 12th December 1898.

1st February 1899.—No. 8.—With reference to Revenue Department Notification No. 16 (Forests), dated the 18th January 1899, Mr. W. T. T. McHarg, Deputy Conservator of Forests, received charge of the No. II Working Plans Party at Pyinmana, on the forenoon of the 15th December 1898.

1st February 1899.—No. 9.—With reference to Revenue Department Notification No. 17, dated the 13th January 1899, Mr. W. T. T. McHarg, made over, and Mr. C. W. Doveton assumed, charge of the No. II Working Plans Party at Pyinmana, on the forenoon of the 1st January 1899.

1st February 1899.—No. 10.—With reference to Revenue Department Notification No. 18, dated the 13th January 1899, Mr. W. T. T. McHarg, Deputy Conservator of Forests, reported his arrival for duty as a Special Girdling Officer, in the Ruby Mines division, on the forenoon of the 7th January 1899.

9th February 1899.—No. 57.—The following alterations in rank are ordered in the Forest Department :—

(1) With effect from the 7th November 1898 :—

Mr. A. H. M. Lawson, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade, substantive provisional, and to officiate as Deputy Conservator, 4th grade.

Mr. G. K. Parker, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade, substantive provisional.

Mr. R. S. Troup, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade, substantive provisional.

(2) With effect from the 9th December 1898 :—

Mr. H. S. Ker-Edie, Assistant Conservator, 1st grade, to be Deputy Conservator, 4th grade, substantive provisional.

Mr. F. Linnell, Deputy Conservator, 4th grade, substantive provisional, to be Assistant Conservator, 1st grade.

So much of this department Notification No. 379, dated the 7th December 1898, as relates to Mr. Ker-Edie's place on the Burma Provincial List is hereby cancelled.

20th February 1899—No. 71.—Under the provisions of Article 282 (1) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. C. W. A. Bruce, Deputy Conservator of Forests, with effect from the 15th March 1899, or the subsequent date on which he may avail himself of it.

No. 72—Mr. S. Carr, Deputy Conservator of Forests, is transferred from the charge of No. I Working Plans Division, Pyinmana, to the charge of the Pyinmana Forest Division, during the absence of Mr. C. W. A. Bruce, Deputy Conservator of Forests, on privilege leave, or until further orders.

No. 73—Mr. F. H. Todd, Assistant Conservator of Forests, on special duty, is posted to the charge of No. I Working Plans Division, Pyinmana, *vice* Mr. S. Carr, transferred.

9.—ASSAM GAZETTE.

22nd February 1899.—No. 1384G.—The following changes in rank are made amongst officers on the Assam Forest list in consequence of the transfers of :—

(1) Mr. T. J. Campbell, Deputy Conservator of Forests, Fourth Grade, from Assam to the North-Western Provinces and Oudh.

(2) Mr. H. S. Ker-Edie, Officiating Deputy Conservator of Forests, Fourth Grade, from Assam to Burma.

(3) Mr. W. F. Perreé, Officiating Deputy Conservator of Forests, Fourth Grade, from Burma to Assam, and

(4) Mr. W. A. R. Doxat, Officiating Assistant Conservator of Forests, First Grade, from the North-Western Provinces and Oudh to Assam—

Mr. W. F. Perreé, Officiating Deputy Conservator of Forests, Fourth Grade, on the Burma list, is confirmed in that grade on the Assam list, with effect from the 27th December 1898.

Mr. W. A. R. Dozat, Officiating Assistant Conservator of Forests, First Grade, on the North-Western Provinces and Oudh list, will continue to officiate in that grade on the Assam list, with effect from the date on which he was relieved of his duties in the North-Western Provinces and Oudh.

22nd February 1899.—No. 1385G.—Mr. J. E. Barrett, Deputy Conservator of Forests, on return from furlough, is posted to Silchar and placed in charge of the Cachar Forest Division, with effect from the 24th November 1898.

10.—HYDERABAD RESIDENCY GAZETTE,

14th February 1899.—No. 54.—Mr. S. L. Kenny, Assistant Conservator of Forests, was attached to the Direction Forest Division from the 28th November to the 1st December 1898, and was transferred to the Ellichpur Forest Division with effect from the 2nd December 1898.

11.—MYSORE GAZETTE.

23rd February 1899.—No. 5844—Pt. F. 7-96.—Under Article 184 of the Mysore Service Regulations, Mr. J. J. Monteiro, Acting Assistant Conservator of Forests, Shimoga district, is granted privilege leave of absence for two months and twenty-four days, with effect from the 15th January 1899.

Mr. Y. Sitaramaiya, Assistant Conservator of Forests, will be in charge of the Sorab Range during the absence of Mr. Monteiro on leave or until further orders.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

14th March 1899.—No. 805-F.—Mr. J. S. Gamble, Conservator of Forests, 1st grade, in charge of the School Circle, North-Western Provinces and Oudh, and Director of the Imperial Forest School, Dehra Dún, is permitted to retire from the public service, with effect from the 11th February, 1899.

On the retirement from the service of Mr. J. S. Gamble, Conservator of Forests, 1st grade, the following arrangements are ordered, with effect from the 11th February, 1899:—

- (i). Mr. H. C. Hill, Conservator, 1st grade, is placed in charge of the School Circle, and is also appointed Director of the Forest School.
- (ii). Mr. E. P. Dansey, Conservator, 2nd grade, North-Western Provinces and Oudh, is promoted to the 1st grade.
- (iii). Mr. J. A. McKee, Conservator, 3rd grade, Central Provinces, and officiating in the 2nd grade, is confirmed in the latter grade.
- (iv). Mr. J. Nisbet, Deputy Conservator, 1st grade, Burma, is promoted to the 3rd grade of Conservators.

2.—MADRAS GAZETTE.

27th February 1899.—*Leave*.—The Board of Revenue has granted, under article 291 of the Civil Service Regulations, privilege leave for one month, from 1st March 1899, to M. R. Ry. C. M. Maduranayagam Pillai Avargal, Extra Assistant Conservator of Forests, South Arcot district.

4th March 1899.—*Leave*.—To M. R. Ry. C. Rajahgopaul Naidu, Ranger, Fifth grade, under transfer to the Nellore district, for one month under article 369 of the Civil Service Regulations in continuation of the leave already granted to him.

7th March 1899.—*Leave*.—The Board of Revenue has granted, under article 291 of the Civil Service Regulations, privilege leave for one month to M. R. Ry. V. Alwar Chetti Gann, Acting District Forest Officer, Trichinopoly cum Tanjore, with effect from the 10th March 1899.

7th March 1899.—*Transfers*.—The following transfers are ordered in the Subordinate Staff of the Southern Circle.

Name and designation of officer.	From	To	REMARKS.
1. M. R. Ry. K. Narayanasami Iyer, Ranger, 5th grade.	North Coimbatore ...	South Coimbatore ...	To join expeditionally.
2. Muhammad Abdul Rahiman Sahib, sub. <i>pro tem</i> . Ranger, 6th Grade,	Tinnevely ...	North do.	To join after the close of the current financial year.

7th March 1899.—*Promotion*.—S. V. Venkatramanaiyar, Deputy Ranger, Second grade, and sub. *pro tem.* Ranger, Sixth grade, South Canara district, to be Ranger, Sixth grade, with effect from 1st March 1899.

11th March 1899.—No. 110.—Appointments.

No.	Name of officer.	Present grade,	Grade to which promoted or reverted.	Nature of promotion or reversion.	Remarks showing cause of vacancy, &c.
1	Mr. O. E. Brasier	Deputy Conservator of Forests, 2nd grade.	Deputy Conservator of Forests, 1st grade.	Acting	With effect from the date of Mr. Brasier's return to duty.
2	„ H. J. A. Porter	Deputy Conservator of Forests, 3rd grade, and acting in the 1st grade.	Deputy Conservator of Forests, 2nd grade.	Do.	
3	„ J. S. Battie	Deputy Conservator of Forests, 3rd grade, and acting in the 2nd grade.	Deputy Conservator of Forests, 3rd grade.	Permanent	
4	„ F. Foulkes	Deputy Conservator of Forests, 4th grade, and acting in the 3rd grade.	Deputy Conservator of Forests, 4th grade.	Do.	
5	„ H. F. Arbuthnot.	Assistant Conservator of Forests, 2nd grade, and Acting Deputy Conservator of Forests, 4th grade.	Assistant Conservator of Forests, 1st grade.	Acting.	
6	„ C. E. Fischer.	Do.	Deputy Conservator of Forests, 4th grade.	Do.	During the absence of Mr Cowley Brown on furlough, or until further orders The appointment to take effect from the date of Mr. Brasier's return to duty.

12th March 1899.—*Confirmation*.—Mr. G. W. Thompson, Ranger, Third grade, sub *pro tem.*, in the North Arcot district, is confirmed in that grade with effect from the 18th November 1898.

13th March 1899.—*Promotion*.—S. Eggianarayana Sastri, Ranger, Fourth grade, is promoted to Ranger, Third grade, with effect from 18th November 1898—*vide* Board's Proceedings, Forest, No 159 Mis., dated 8th March 1899.

13th March 1899.—*Promotions.*—The following promotions are ordered in the Ranger's class of the Southern Circle with effect from 15th November 1898.

Name.	Present grade.	Grade to which promoted.	Nature of promotion.
Mr. N. M. Rego ...	3rd grade ...	2nd grade	Permanent.
M. R. Ry. A. S. Mariaprakasam Pillai ..	3rd do ...	2nd do	Do.
Mr. A. F. X. Saldanha ...	4th do ...	3rd do	Do.
Mr. C. Hammond ..	5th do ...	4th do	Do.
M. R. Ry M. Panchapakasa-Iyer ...	5th do ..	4th do	Do.
„ P. Venkatakrishnama Naidu	6th do and sub. grade <i>pro tem.</i> 5th	5th do	Do.
„ S. Kuppuswami Chetti	6th grade ...	5th do	Do.

15th March 1899.—No. 120.—Mr. H. F. Arbuthnot, Assistant Conservator of Forests, North Coimbatore, is granted privilege leave for three months, with effect from the 5th April 1899, in continuation of the Easter Holidays, subject to the conditions stated in article 251 of the Civil Service Regulations.

15th March 1899.—No. 121.—Under article 344 (a) of the Civil Service Regulations, Mr. W. C. Hayne, Deputy Conservator of Forests, Madras, is granted leave on medical certificate for two months in extension of the furlough for two years already granted to him.

15th March 1899.—*Transfers.*—The following transfers are ordered :—

1. Mr. R. S. Bower, Ranger, Fifth grade, from the Salem district to the South Arcot district. To join.

2. M. R. Ry. A. N. Hanumantha Row, Ranger, Fourth grade, from the South Arcot district to the Salem district, on relief by Mr. Bower.

18th March 1899 —No. 124.—

Name and designation of officer.	Province.	Nature of charge.	REMARKS.
Mr. M. Muttannab, Extra Deputy Conservator of Forests, Fourth grade.	Bellary	Chief Forest officer.	Transferred from the Central Province.

18th March 1899.—No 126.—Under instructions from the Government of India, the services of Mr. C. D. McArthy, Acting Deputy Conservator of Forests, Third grade, will be placed at the disposal of the Chief Commissioner, Oorg, for appointment as Chief Forest Officer of that Province. Mr. McArthy will join at once, handing over charge to the Collector of Bellary.

20th March 1899.—No. 118.—Mr. C. J. Woutersz, Extra Assistant Conservator of Forests, North Coimbatore, is granted leave on medical certificate for two months and fourteen days, with effect from the 10th October 1898, under article 369 of the Civil Service Regulations.

27th March 1899.—Mr. J. S. Battie, District Forest Officer, South Canara, is granted furlough for eight months, with effect from or after the 20th April 1899, under article 340 (b) of the Civil Service Regulations.

28th March 1899.—No. 129.—Mr. O. E. C. Fischer, District Forest Officer, Ganjam, is granted privilege leave for three months, with effect from or after the 15th April 1899, under article 291 of the Civil Service Regulations.

28th March 1899.—*Erratum.*—In notification No. 124, published at page 325 of Part I of the *Port St George Gazette* dated 21st March 1899, for "Province" read "District" and for "Chief Forest Officer" read "District Forest Officer."

3.—BOMBAY GAZETTE.

17th March 1899.—No. 8604.—Messrs. W. A. Talbot, Deputy, and W. E. Copleston, acting Deputy Conservator of Forests, respectively delivered over and received charge of the Belgaum Forest Division on the forenoon of the 14th instant.

Mr. W. E. Copleston, acting Deputy Conservator, gave over charge of the Forest Working Plans Division, Southern Circle, to Mr. N. D. Satarawala, Extra Assistant Conservator of Forests, on the afternoon of the 4th instant.

Mr. H. A. Nadkarni, Extra Assistant Conservator of Forests, handed over charge of the Sub-Division Office, Southern Division of Kanara, to Mr. H. Murray, Deputy Conservator and Divisional Forest Officer, Southern Division, Kanara, on the forenoon of the 1st instant, and assumed that of the Dhrawar Forest Division, on the forenoon of the 4th idem.

22nd March 1899.—No. 2115.—Mr. R. C. Wroughton, Conservator of Forests, Second grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period, of his leave.

24th March 1899.—No. 2158.—His Excellency the Governor in Council is pleased to appoint Mr. R. S. Pearson to be Divisional Forest Officer, West Khandesh.

4.—BENGAL GAZETTE.

7th February 1899.—No. 571—Forests.—Mr. E. G. Chester, Deputy Conservator of Forests, is granted two months' privilege leave, under articles 277 and 291 of the Civil Service Regulations, with effect from the 7th February 1899, or any subsequent date on which he may avail himself of it.

17th March 1899.—No. 1192.—The services of Mr. E. G. Chester, Deputy Conservator of Forests, Bengal, are placed at the disposal of the

Government of India, with effect from the date on which the leave granted to him in Notification No. 571, Forests, dated the 7th February 1899, expires.

18th March 1899.—No 1212.—Consequent on the retirement from the service of Mr. C. A. G. Lillingston, Deputy Conservator of Forests, the following officers are promoted with effect from the 27th August 1898.

Mr. R. L. Heining, Deputy Conservator of Forests, 4th grade, officiating in the 2nd grade, is promoted to the 3rd grade, but will continue to officiate in the 2nd grade of Deputy Conservators till further orders.

Mr. W. F. Lloyd, Officiating Deputy Conservator of Forests, 4th grade, is confirmed in that grade.

Mr. E. P. Stebbing, Officiating Assistant Conservator of Forests, 1st grade, is confirmed in that grade.

5.—N.-W. P. AND OUDH GAZETTE.

3rd March 1899.—No. $\frac{629}{11-80 A}$ —The following reversions in the Forest Department are notified for general information :—

Entry No.	With effect from.	Consequent on.	Name.	From.	To.
1	8th February 1899.	Mr. N. Hearle's return from privilege leave.	Mr. B. A. Rebsch. „ L. Mercer „ P. H. Clutterbuck Mr. J. C. Tullock. „ F. F. R. Channer	Officiating Deputy Conservator, 1st grade Officiating Deputy Conservator, 2nd grade. Officiating Deputy Conservator, 3rd grade. Officiating Deputy Conservator, 4th grade. Officiating Assistant Conservator, 1st grade.	Deputy Conservator, 2nd grade, <i>Pro. sub.</i> Deputy Conservator, 3rd grade, <i>Pro. sub.</i> Deputy Conservator, 4th grade. Assistant Conservator, 1st grade. Assistant Conservator, 2nd grade.

6th March 1899.—No. $\frac{675}{11-81 C}$ —Notification No. $\frac{331}{11-81 C}$, dated the 9th February 1899, recalling Pandit Rama Dutt, Extra Assistant Conservator of Forests, from leave, and posting him to the charge of the Jaunsar Forest Division of the School Circle, is hereby cancelled.

22nd March 1899.—No. $\frac{1039}{11-83 B}$ —With effect from the 24th December 1898, and in supersession of Notification No. $\frac{490}{11-83 B}$, dated the 2nd March 1897, Pandit Sajanand Gurola, Extra Assistant Conservator of Forests, from the 4th to the 3rd grade, *sub. pro. tem.*

22nd March 1899.—No. $\frac{1040}{11-665B}$ —In modification of Notification No. $\frac{1048}{11-665B}$, dated the 24th July 1897, and in supersession of Notification No. $\frac{2896}{11-665B}$, dated the 6th October 1897, Pandit Sadanand Gairola, Extra Assistant Conservator of Forests, 3rd grade, sub. *pro. tem.*, to be confirmed in that grade with effect from the 21st April 1897.

22nd March 1899.—No. $\frac{1041}{11-665B}$.—In modification of Notification No. $\frac{1048}{11-665B}$, dated 24th July 1897, and in supersession of Notification No. $\frac{2825}{11-665B}$, dated the 6th October 1897, Mr. E. L. Haslett to revert to Extra Assistant Conservator of Forests, 4th grade, with effect from the 24th December 1898.

24th March 1899.—No. $\frac{1094}{11-3920}$.—Mr. F. A. Leete, officiating Deputy Conservator of Forests, in charge of the Bahraich Division of the Oudh Forest Circle, to hold charge of the Gonda division of the same Forest Circle, in addition to his other duties.

6.—PUNJAB GAZETTE.

2nd March 1899.—No. 108.—Pandit Gokal Dass, Probationary Extra Assistant Conservator of Forests, returned from the Marwar State and has been attached to the Rawalpindi Forest Division from the afternoon of the 11th February 1899.

3rd March 1899.—No. $\frac{112}{A. L. No. 9}$.—Mr. C. Somers-Smith, Deputy Conservator of Forests, on return from furlough granted in Punjab Government Notification No. $\frac{78}{A. L. No. 8}$, dated 8th February 1898, landed at Bomhay on the afternoon of the 28th January 1899, and reported his arrival at Lahore on the forenoon of the 6th February 1899.

He remained attached to the Direction Division up to the afternoon of the 9th February 1899, when he took over charge of that Division, relieving Mr. B. O. Coventry, Deputy Conservator of Forests, who will henceforth remain in charge of the Lahore Forest Division only.

6th March 1899.—No. 120.—Bhái Sádhu Singh, Extra Assistant Conservator of Forests, on return from privilege leave granted in Punjab Government Notification No. 66, dated 4th February 1899, resumed duty in the Chamba Forest Division on the forenoon of the 17th idem.

7th March 1899.—No. 123.—Consequent on the return to duty from deputation of Pandit Gokal Das, Probationary Extra Assistant Conservator of Forests, 4th grade, Lala Sunder Das, Provisional Extra Assistant Conservator of Forests, reverted to Forest Ranger, 1st grade, with effect from the 12th February 1899.

7.—CENTRAL PROVINCES GAZETTE.

2nd March 1899.—No. 921.—Furlough on medical certificate for nine months, under article 343 of the Civil Service Regulations, is granted to Mr. L. Gisborne-Smith, Deputy Conservator of Forests, Jubbulpore Forest Division, with effect from the 11th March 1899, or the subsequent date on which he may avail himself of it.

13th March 1899.—No. 49.—Leave on medical certificate for three months, under article 369 of the Civil Service Regulations, is granted to Deputy Ranger Barkhardar Ali, Permanent Establishment, Nimar Forest Division, with effect from the 13th January 1899.

14th March 1899.—No. 1085.—Mr. R. S. Hole, Provisional Assistant Conservator of Forests, 1st grade, Damoh Forest Division, is appointed to hold charge of the Jubbulpore Forest Division during the absence on furlough of Mr. L. Gisborne-Smith, or until further orders.

14th March 1899.—No. 1086.—Mr. D. O. Witt, Assistant Conservator of Forests, 2nd grade, temporarily attached to the office of the Conservator of Forests, Northern Circle, is appointed to hold charge of the Damoh Forest Division, *vice* Mr. R. S. Hole, transferred to Jubbulpore.

16th March 1899.—No. 1129.—On return from the extraordinary leave granted him by Order No. 3996, dated the 9th November 1898, Mr. F. S. Barker, Deputy Conservator of Forests, 2nd grade, is posted to the charge of the Nagpur-Wardha Division, during the absence on furlough of Mr. F. O. Lemarchand, Deputy Conservator of Forests, or until further orders.

16th March 1899.—No. 1130.—Mr. Narayan Parshad Bajpai, Extra Assistant Conservator, is transferred from Chanda, and is appointed to hold temporary charge of the Nagpur-Wardha Division, until relieved by Mr. F. S. Barker.

8.—BURMA GAZETTE.

24th February 1899.—No. 74.—Under the provisions of articles 277 and 291 of the Civil Service Regulations, privilege leave for 28 days is granted to Mr. A. H. M. Lawson, Assistant Conservator of Forests, with effect from the 4th March 1899, or the subsequent date on which he may avail himself of it.

24th February 1899.—No. 79.—Mr. F. Linnel, Assistant Conservator, 1st grade, is appointed to officiate as Deputy Conservator, 4th grade, with effect from the 9th December 1898.

24th February 1899.—No. II.—Mr. R. U. A. Pinder, Forest Ranger, relinquished charge of his duties in the Pyinmana division on the forenoon of the 11th January 1899, and reported his arrival at Mandalay for duty on the afternoon of the 16th January 1899.

24th February 1899.—No. 12.—Mr. E. B. Powell, Extra Assistant Conservator of Forests, made over, and Mr. R. C. A. Pinder, Forest Ranger, received, charge of the Revenue subdivision, Mandalay Forest division, on the afternoon of the 3rd February 1899.

24th February 1899.—No. 13.—Mr. E. B. Powell, Extra Assistant Conservator of Forests, availed himself of the three months' privilege leave granted him in Revenue Department Notification No. 21 (Forests), dated the 15th January 1899.

26th February 1899.—No. 2.—With reference to Revenue Department Notification No. 58 (Forests), dated the 10th February 1899, Mr. H. Hill, Deputy Conservator of Forests, assumed charge of his duties as Personal Assistant to the Conservator of Forests, Pegu Circle, on the forenoon of the 6th February 1899.

7th March 1899.—No. 82.—Mr. F. H. Todd, Assistant Conservator of Forests, was transferred from the charge of the Yaméthin sub-division, of the Pyinmana Forest division, to duty in the Pyinmana division.

9th March 1899.—No. 91.—Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, on return from deputation to the Andamans is posted to the charge of the Minbu Forest division, *vice* Mr. C. E. Muriel, Deputy Conservator of Forests, proceeding on leave.

9th March 1899.—No. 92.—Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, is transferred from the charge of the Myadaung sub-division, Katha Forest division, to Port Blair.

18th March 1899.—No. 14.—With reference to Revenue Department Notification No. 73 (Forests), dated the 20th February 1899, Mr. S. Carr, Deputy Conservator of Forests, made over, and Mr. F. H. Todd, Assistant Conservator of Forests, received, charge of the No. I Working Plans Division, Pyinmana, on the afternoon of the 7th instant.

17th March 1899.—No. 110.—Under the provisions of Articles 277 and 291 of the Civil Service Regulations, privilege leave for one month and nine days is granted to Mr. C. E. Muriel, Deputy Conservator of Forests, with effect from the 25th March 1899, or the subsequent date on which he may avail himself of it.

Mr. Muriel is permitted to overstay his leave by 15 days.

17th March 1899.—No. 111.—The following alterations in rank are ordered in the Forest Department:—

- (1) With effect from the 7th November 1898, Mr. H. W. A. Watson, Assistant Conservator, 2nd grade, to officiate as Assistant Conservator, 1st grade.
- (2) With effect from the 6th February 1899, consequent on the return from furlough of Mr. M. Hill:

Mr. H. H. Forteach, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, substantive provisional, officiating Deputy Conservator, 4th grade, to revert to his substantive appointment.

21st March 1899.—No. 113.—Under the provisions of Article 310 (b) of the Civil Service Regulations, furlough for one year and ten months is granted to Mr. J. Copeland, Deputy Conservator of Forests, with effect from the 1st April 1899, or the subsequent date on which he may avail himself of it.

21st March 1899.—No. 114.—Mr. C. B. Dun, Deputy Conservator of Forests, is transferred from the Northern Shan States to the charge of the Mandalay Forest division during the absence of Mr. Copeland on furlough or until further orders.

21st March 1899.—No. 117.—Mr. F. B. Dickinson, Conservator of Forests, has been granted by Her Majesty's Secretary of State for India, an extension of furlough for six months on medical certificate.

21st March 1899.—No. 15.—Mr. C. W. A. Bruce, Deputy Conservator of Forests, Pyinmana division, availed himself of the three months' and 15 days' privilege leave granted him in Revenue Department Notification No. 71 (Forests), dated the 21st February 1899, on the afternoon of the 17th instant.

21st March 1899.—No. 16.—With reference to Revenue Department No. 72, dated the 21st February 1899, Mr. C. W. A. Bruce, Deputy Conservator of Forests, made over, and Mr. S. Carr, Deputy Conservator of Forests, received, charge of the Pyinmana forest division on the afternoon of the 17th instant.

21st March 1899.—No. 17.—Mr. A. H. M. Lawson, Assistant Conservator of Forests, availed himself on the forenoon of the 1st instant of the 28 days' privilege leave granted him in Revenue Department Notification No. 74 (Forests), dated the 24th February 1899.

25th March 1899.—No. 18.—With reference to Revenue Department Notification No. 92 (Forests), dated the 9th instant, Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, made over, and Mr. H. McJ. Carson, Forest Ranger, received, charge of the Myadaung sub-division, Katha Forest Division, on the afternoon of the 6th instant.

9.—ASSAM GAZETTE.

1st March 1899.—No. 1549G.—The following promotions are made amongst Officers on the Assam Forest list, with effect from the 3rd January 1899, in consequence of the deputation of Mr. J. L. Pigot, Deputy Conservator of Forests, Second Grade (Officiating in the First Grade), to the Mysore State :

Mr. D. P. Copeland, Officiating Deputy Conservator, Second Grade, to be provisionally substantive in that grade, and to officiate as Deputy Conservator, First Grade.

Mr. H. G. Young, Officiating Deputy Conservator, Third Grade, to be provisionally substantive in that grade, and to officiate as Deputy Conservator, Second Grade.

Mr. J. E. Barrett, Deputy Conservator, Fourth Grade, to officiate as Deputy Conservator, Third Grade.

Mr. F. E. B. Lloyd, Assistant Conservator First Grade, on furlough, to be provisionally substantive as Deputy Conservator, Fourth Grade.

10.—HYDERABAD RESIDENCY GAZETTE.

Nil

11.—MYSORE GAZETTE.

17th March 1899.—No. 6513—*Ft. F.* 89-95.—Under Article 172 of the Mysore Service Regulations, Mr. K. Shamiengar, Acting Assistant Conservator of Forests, Chitaldrug district, is granted casual leave of absence for ten days, with effect from the 20th instant or such other date as he may avail himself of the same.

18th March 1899.—No. 6578—*Ft. F.* 62-95.—The twelve days' casual leave of absence granted in Government Notification No. 6483—*Ft. F.* 62-95, dated 15th instant, to Mr. M. G. Rama Rao, Assistant Conservator of Forests, Mysore district, is hereby extended by three days.

22nd March 1899.—No. 6663—*Ft. F.* 123-95.—Under Article 172 of the Mysore Service Regulations, Mr. C. Appaiya, Assistant Conservator of Forests attached to the office of the Conservator of Forests in Mysore, is granted casual leave of absence for twelve days, with effect from the 28th March 1899 or such other date as he may avail himself of the same.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

14th April 1899.—No. 348 F.—Furlough for eight months, under article 340 (b), of the Civil Service Regulations, is granted to Mr. S. Eardley-Wilmot, Conservator, 2nd grade, in charge of the Oudh Forest Circle in the North-Western Provinces and Oudh, with effect from the afternoon of the 4th April 1899.

The following arrangements are made during Mr. Wilmot's absence, or until further orders :

- (i) Mr. A. L. Home, Conservator, 1st grade, to hold charge of the Oudh Forest Circle, with effect from the afternoon of the 4th April 1899.
- (ii) Mr. E. G. Chester, Deputy Conservator, 1st grade, Bengal, to officiate as Conservator, 3rd grade, and to hold charge of the Assam Forest Circle, with effect from the forenoon of the 1st April 1899, when he relieved Mr. Home of the charge of that Circle.
- (iii) Mr. A. Smythies, Conservator, 3rd grade, Burma, to officiate in the 2nd grade, with effect from the 5th April 1899.

14th April 1899.—No. 353 F.—Furlough for one year, under articles 339 (a) and 340 (b), of the Civil Service Regulations, is granted to Mr. J. A. McKee, Conservator, 2nd grade, in charge of the Southern Forest Circle in the Central Provinces, with effect from the forenoon of the 7th April 1899.

From the same date and until further orders Mr. N. Hearle, Deputy Conservator, 1st grade, North-Western Provinces and Oudh, is appointed to officiate as Conservator, 3rd grade, and to be in charge of the Southern Forest Circle in the Central Provinces.

20th April 1899.—No. 378 F.—Privilege leave for two months and seventeen days is granted, under article 291 of the Civil Service Regulations, to Mr. A. F. Graddon, Instructor at the Imperial Forest School, Dehra Dun, with effect from the forenoon of the 5th April 1899.

2.—MADRAS GAZETTE.

27th March 1899 No. 146.—*Posting.*

No.	Name of officer.	District.	Nature of charge	Remarks.
1	Mr J. L. Mac O'Leary	Kurnool	Acting District Forest Officer.	As a temporary arrangement.

28th March 1899.—*Transfer.*—The following transfer is ordered :—

No.	Name and designation of officer.	From	To	Remarks.
1	Mr. T. N. Hearsey, Extra-Assistant Conservator of Forests, Third grade.	The North-ern Circle.	The Central Circle.	

30th March 1899.—*Leave*.—S. Eggianarayana Sastri, Forest Ranger, Bellary district, is granted privilege leave for three months, to take effect from date of relief.

4th April 1899.—No. 147.—*Posting*.

No.	Name and designation of officer.	District.	Nature of charge.	Remarks.
1	Mr. O. B. Dawson, Assistant Conservator of Forests, 2nd Grade.	Ganjam	Acting District Forest Officer.	During the absence of Mr. O. E. C. Fischer on leave, or until further orders.

5th April 1899.—*Postings and transfers*.—The following posting, and transfers are ordered :—

Mr. T. N. Hearsey, Extra Assistant Conservator, 3rd grade, transferred from the Northern circle, is posted to the Cuddapah district.

M. R. Ry. T. Bapu Row, Ranger, 2nd grade, from the Cuddapah to the Chingleput district.

M. R. Ry. C. Subramania Aiyar, Ranger, 4th grade, from the Cuddapah to the Nellore district on relief by R. Sama Rao.

M. R. Ry. R. Srinivasa Raghavachari, Acting Ranger, 6th grade, from the Chingleput district to the Trichinopoly district.

6th April 1899.—*Leave*.—The Board of Revenue has granted under article 291, Civil Service Regulations, privilege leave for one month to Mr. A. B. Jackson, District Forest Officer, South Malabar, with effect from or after 5th May 1899.

6th April 1899.—No. 142.—Mr. F. A. Lodge, District Forest Officer, South Coimbatore, is granted furlough for one year and four months, with effect from the 16th April 1899, under article 340 (b) of the Civil Service Regulations.

6th April 1899.—No. 153.—*Posting*.

No.	Name and designation of officer.	District.	Nature of charge.	Remarks.
1	Mr. H. A. Latham, Acting Deputy Conservator of Forests, Fourth Grade.	South Coimbatore.	Acting District Forest Officer.	During the absence of Mr. F. A. Lodge on furlough, or until further orders.
2	Mr. S. C. Moss, Extra Assistant Conservator of Forests, Second Grade.	North Malabar.	Do.	During the absence of Mr. H. Tireman on special leave, or until further orders.

11th April 1899.—No. 141.—Mr. H. Tireman, District Forest Officer, North Malabar, is granted special leave on private affairs for six months, with effect from or after 27th April 1899, under article 348 of the Civil Service Regulations.

12th April 1899.—*Certificate in Forestry*—R. Sama Rao, Deputy Ranger, First Grade, is declared to have obtained the certificate in Forestry (Higher Standard) at the final examination of 1899 of the Forest School, Dehra Dun.

12th April 1899.—*Transfer*.—Mr T. M. Nallasami Naidu, Extra Assistant Conservator of Forests, is transferred from Kistna to Kurnool district.

13th April 1899.—*Dehra Dun School*.—The following is the result for the Government student who was deputed from the Southern Circle to the Dehra Dun Forest School in 1897 :—

Rank 5 out of 21	—
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G. S. Lasrado obtained the Higher Standard certificate with prize for best note-book in Forestry and Forest Engineering and for the best Herbarium

14th April 1899.—*Promotion*—The following promotion is ordered with effect from 1st April 1899:—

M. R. Ry R. Sama Rao, Deputy Ranger, First Grade, Cuddapah district, to be Ranger, Sixth Grade in the same district.

16th April 1899.—*Transfer*—M. R. Ry. A. P. Ramchendra Mudaliar, Ranger, Fourth Grade, is transferred from the Trichinopoly district to the Tanjore district.

15th April 1899.—*Leave*.—P. Ananda Row, Ranger, Ganjam district, is granted privilege leave for three months from date of relief.

21st April 1899.—*Promotion*—A Sreenivasa Hebbar, D. D. A., to be Ranger, Sixth Grade, from 1st April 1899

21st April 1899.—*Services dismissed*.—N. Subramania Aiyar, a Forester in the Salem district, having been convicted of criminal offences punishable under sections 379, 384 and 114 of the Indian Penal Code, is dismissed from public service.

22nd April 1899—No 171.—Mr. H. B. Bryant, District Forest Officer, Tinnevely, is granted privilege leave for one month and six days, with effect from the 1st May 1899, under article 291 of the Civil Service Regulations

26th April 1899—No 180.—The furlough for one year granted to Mr. A. W. Peet, Conservator of Forests, Northern Circle in notification No. 85, published at page 48 of the *Port St George Gazette* dated the 25th January 1898 has been extended to 16th December 1899 by the Right Honourable the Secretary of State for India.

28th April 1899.—No. 181.—*Posting*.—

No.	Name and designation of officer.	District.	Nature of charge.
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Mr. W. Carroll, Extra Assistant Conservator of Forests, First Grade.	Trichinopoly Tanjore	cum	Acting District Forest Officer.
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3.—BOMBAY GAZETTE.

5th April 1899.—No. 2328.—Mr H. W. Keys, Deputy Conservator of Forests, Third Grade, has been allowed by Her Majesty's

Secretary of State for India an extension of furlough for five months and three days.

6th April 1899.—No. 2372.—His Excellency the Governor in Council is pleased to make the following appointments *vice* Mr. A. T. Shuttleworth, retiring :—

Mr. R. C. Wroughton to be Conservator of Forests, First Grade, and to hold charge of the Central Circle.

Mr. F. R. Dassai to be Conservator of Forests, Second Grade, and to hold charge of the Northern Circle.

Mr. T. B. Fry to be Conservator of Forests, Third Grade, and to hold charge of the Southern Circle.

Mr. W. A. Talbot to be Deputy Conservator of Forests, First Grade.

Mr. A. D. Wilkins to be Deputy Conservator of Forests, Second Grade.

Mr. E. G. Oliver to be Deputy Conservator of Forests, Third Grade.

Mr. G. R. Duxbury to be Deputy Conservator of Forests, Fourth Grade

Mr. E. M. Hodgson to be Assistant Conservator of Forests, First Grade.

2. His Excellency the Governor in Council is also pleased to appoint—

Mr. W. J. Betham, Deputy Conservator of Forests, First Grade, to hold charge of the Sind Circle.

and pending Mr. Wroughton's return from leave, Mr. A. D. Wilkins to act as Deputy Conservator of Forests, First Grade, and to hold charge of the Central Circle.

7th April 1899.—No. 63.—Messrs. E. M. Hodgson, I. F. S., delivered over and C. G. Dalia, L.C.E., Extra Assistant Conservator of Forests, received charge of the Sub-Divisional Forest Office, Surat, in the afternoon of the 18th March 1899.

11th April 1899.—No. 2520.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. V. D. P. Rebeiro, L. O. E., to be Extra Assistant Conservator of Forests, Second Grade, *vice* Mr. J. H. Clabby, deceased.

Mr. Ganpat Jayavant Rege to be substantive *pro tem.* Extra Assistant Conservator of Forests, Third Grade, *vice* Mr. Rebeiro, promoted.

Mr. Govind Ramchandra Takle to be substantive *pro tem.* Extra Assistant Conservator of Forests, Fourth Grade, *vice* Mr. Rege, and to hold charge of the Divisional Forest Office, Sholapur, during the absence of Mr. Vaman Ramchandra Gavande or pending further orders.

11th April 1899.—No. 2521.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. V. D. P. Rebeiro, L. O. E., to act as Divisional Forest Officer, Dharwar, pending further orders.

Mr. Balwant Ganesah Deshpande to act as Divisional Forest Officer, Bijapur, pending further orders.

Mr. Govind Ramchandra Takle, on relief at Sholapur, to be Extra Assistant Conservator of Forests, Kolaba.

11th April 1899.—No. 183.—Mr. A. D. Wilkins, Deputy Conservator of Forests, handed over and Mr A. N. Master, Ex-ra Assistant Conservator of Forests, received charge of the Sátara Divisional Forest Office on the afternoon of the 4th instant

17th April 1899.—No. 2671.—Mr. W. G. Betham, acting Conservator of Forests, Southern Circle, is allowed privilege leave of absence for one month.

18th April 1899.—No. 363.—Messrs. R. S. Pearson, Assistant Conservator of Forests, and G. P. Millet, Deputy Conservator of Forests, respectively delivered over and received charge of the Sub-divisional Forest Office, Nasik, on the forenoon of the 5th April 1899.

21st April 1899.—No. 2750.—Mr. A. D. Wilkins, Deputy Conservator of Forests in charge Central Circle, is granted furlough for eighteen months.

21st April 1899.—No. 2773.—His Excellency the Governor in Council is pleased to appoint Mr. G. M. Ryan to hold charge of the office of Conservator of Forests, N. C., in addition to his own duties, pending further orders.

21st April 1899.—No. 2806.—His Excellency the Governor in Council is pleased to appoint Mr. Ardeshir Nasarvanji Master, L.C.E., to hold charge of the Divisional Forest Office, Satara, pending further orders.

26th April 1899.—No. 2859.—The following officer passed an examination in Marathi according to the Higher Standard on the 6th April 1899 :—

* * * *

Mr. O. H. L. Napier, Deputy Conservator of Forests, Poona.

26th April 1899.—No. 594.—Mr. R. H. Madan, Extra Deputy Conservator of Forests, delivered over and Mr. Ralph S. Pearson, Assistant Conservator of Forests, received charge of the Divisional Forest Office, West Khandesh, on 10th April 1899, in the forenoon.

27th April 1899.—No. 2907.—His Excellency the Governor in Council is pleased to make the following appointments in modification of so much of Government Notification No. 2521, dated 11th April 1899, as relates to the appointment of Mr. V. D. P. Rebeiro L.C.E.:—

Mr. W. A. Wallinger to be Divisional Forest Officer, Dharwar.

Mr. V. D. P. Rebeiro, L.C.E., to be Divisional Forest Officer Panch Mahals.

27th April 1899.—No. 2908.—His Excellency the Governor in Council is pleased to appoint Mr. O. H. L. Napier to hold charge of the office of Divisional Forest Officer, Sholapur, in addition to his own duties, during the absence of Mr. Vaman Ramchandra Gavande.

4.—BENGAL GAZETTE.

11th April 1899.—No 1539.—Mr. C. G. D. Fordyce, Deputy Conservator of Forests, in charge of the Sunderbans Division, is granted privilege leave for two months and fifteen days, under articles 277 and 291 of the Civil Service Regulations, with effect from the 18th April 1899, or any subsequent date on which he may avail himself of it.

Mr. J. P. Haslett, Extra Assistant Conservator of Forests, attached to the Sunderbans Division, will hold charge of that Division, during the absence on leave of Mr. Fordyce, or until further orders.

25th April 1899.—No 1800.—Mr. T. H. Montearth, Assistant Conservator of Forests, attached to the Darjeeling Division, is granted 14 days' examination leave, under article 223 of the Civil Service Regulations, with effect from the 24th April 1899, or from such subsequent date on which he may avail himself of it.

5.—N.-W. P. AND OUDH GAZETTE.

4th April 1899.—No. ¹²²²~~II-3920~~—Mr. F. F. R. Channer, Assistant Conservator of Forests, attached to the Garhwal Forest Division of the Central Circle, to the charge of the Gonda Forest Division of the Oudh Circle.

21st April 1899.—No. ¹⁴¹¹~~II-665B~~. With effect from the 16th December 1898, Babu Nand Mal, Extra Assistant Conservator of Forests, 4th grade, to be Extra Assistant Conservator of Forests, 3rd grade, *sub pro tem*.

6.—PUNJAB GAZETTE.

4th April 1899.—No. ¹⁶⁵~~A. L. No. 10~~ The reversions consequent on the return of Mr. C. Bagshawe, Conservator of Forests, from furlough, notified in Punjab Government Notification No. ¹⁰²~~A. L. No. 8~~, dated 27th February 1899, are hereby cancelled.—

No. ¹⁶⁶~~A. L. No. 11~~ The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified against each :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. O P. Fisher ...	Deputy Conservator, 4th Grade.	Offg. Deputy Conservator, 3rd Grade.	Korenoon 30th December 1898.	Consequent on Mr. C. P. Fisher's return from furlough.
Mr. E. M. Coventry	Offg. Deputy Conservator, 3rd Grade.	Provisional Deputy Conservator, 4th Grade.	Ditto.	
Mr. S. L. Kenny...	Offg. Deputy Conservator, 4th Grade.	Offg Assistant Conservator, 1st Grade.	Ditto.	

EXTRACTS FROM OFFICIAL GAZETTES.

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Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. S. L. Kenny ..	Provisional Assistant Conservator, 1st Grade	Offg. Deputy Conservator, 4th Grade.	Afternoon 17th January 1899.	Consequent on Mr. E. M. Coventry's departure on furlough for one year.
Mr. A. E. Lowrie	Offg. Deputy Conservator, 2nd Grade.	Deputy Conservator, 3rd Grade.	Forenoon 19th January 1899.	Consequent on return of Mr. H. A. Houghton from privilege leave.
Mr. A. W. Blunt ..	Offg. Deputy Conservator, 3rd Grade.	Deputy Conservator, 4th Grade	Ditto.	
Mr. S. L. Kenny	Offg. Deputy Conservator, 4th Grade.	Offg. Assistant Conservator, 1st Grade.	Ditto.	
Mr. C. Somers Smith.	Deputy Conservator, 4th Grade.	Offg. Deputy Conservator, 3rd Grade.	Forenoon 18th February 1899.	Consequent on Mr. Somers Smith's return from furlough.
Mr. A. V. Monroe ..	Offg. Deputy Conservator, 3rd Grade.	Deputy Conservator, 4th Grade.	Ditto	
Mr. W. Mayes ..	Offg. Deputy Conservator, 4th Grade.	Provisional Assistant Conservator, 1st Grade	Ditto.	
Mr. J. H. Lacey ..	Deputy Conservator, 2nd Grade.	Offg. Deputy Conservator, 1st Grade.	Forenoon 18th February 1899.	Consequent on Mr. F. O. Lemarchand's departure on furlough for two years.
Mr. A. E. Lowrie.	Deputy Conservator, 3rd Grade.	Offg. Deputy Conservator, 2nd Grade	Ditto.	
Mr. A. V. Monroe...	Deputy Conservator, 4th Grade.	Offg. Deputy Conservator, 3rd Grade.	Ditto.	
Mr. W. Mayes ...	Provisional Assistant Conservator, 1st Grade.	Offg. Deputy Conservator, 4th Grade.	Ditto.	

4th April 1899.—No. $\frac{171}{A. L. No. 12}$ Messrs. C. Somers Smith and B. O. Coventry, Deputy Conservators of Forests, respectively made over and received charge of the Direction Division and the duties of the Personal Assistant to Conservator of Forests, Punjab, on the afternoon of the 23rd March 1899, consequent on the transfer of the former to the Central Provinces.

18th April 1899.—No. $\frac{184}{A. L. No. 18}$ —The following change has taken place in the List of Forest Officers in the Associated Provinces with effect from the date specified :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	Remarks.
Mr. R. S. Hole,	Officiating Deputy Conservator, 4th Grade.	Officiating Assistant Conservator, 1st Grade.	27th Novem-ber 1898.	Consequent on the return of Mr. S. L. Kenny from privilege leave.

7.—CENTRAL PROVINCES GAZETTE.

5th April 1899.—No 1.—Leave on medical certificate for two months, under Article 369 of the Civil Service Regulations, is granted to Bastiram, Deputy Ranger, Betul Forest Division, with effect from the 11th March 1899.

14th April 1899.—No. 1532.—On return from the leave on medical certificate granted him by Order No. 262, dated the 19th January 1899, Mr. A. M. Long, Provisional Deputy Conservator of Forests, 4th grade, is attached to the Southern Circle, Central Provinces, and is temporarily posted to the Direction Division.

14th April 1899.—No. 1537.—Mr. A. M. Long, Provisional Deputy Conservator of Forests, temporarily attached to the Direction Division, Southern Circle, is transferred to the charge of the Raipur Forest Division.

14th April 1899.—No. 1538.—On being relieved by Mr. A. M. Long, Mr. A. W. Blunt, Officiating Deputy Conservator of Forests, 3rd grade, Raipur Forest Division, is deputed to Foreign service for special temporary duty in the Bastar Feudatory State.

20th April 1899.—No. 1676.—Mr. A. P. Percival, Assistant Conservator of Forests, attached to the Chanda Forest Division, is transferred to Nagpur, and is attached to the Direction Division, Southern Circle, until further orders.

8.—BURMA GAZETTE.

30th March 1899.—No. 127.—Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, is appointed to the charge of the Minbu Forest

division, in addition to his other duties, with effect from the date of taking over charge from Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests.

10th April 1899.—No. 19.—Mr. A. H. M. Lawson, Assistant Conservator of Forests, returned from the leave granted him in Revenue Department Notification No. 74 (Forests), dated the 24th February 1899, on the forenoon of the 28th March 1899.

10th April 1899.—No. 134.—Under the provisions of Article 282 (c) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. H. B. Ward, Deputy Conservator of Forests, with effect from the 21st April 1899, or the subsequent date on which he may avail himself of it.

15th April 1899.—No. 3.—With reference to orders contained in Forest Department letter No. 432-2A.—10, dated the 20th March 1899, from the Revenue Secretary to the Government of Burma, Mr. C. E. Muriel, Deputy Conservator of Forests, made over, and Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, received charge of the Minbu division on the afternoon of the 23th March 1899.

15th April 1899.—No. 4.—With reference to Revenue Department Notification No. 127 (Forests), dated Rangoon, the 30th March 1899, Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, made over, and Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, received charge of the Minbu division on the forenoon of the 4th April 1899.

17th April 1899.—No. 20.—Mr. J. Copeland, Deputy Conservator of Forests, availed himself of the one year and ten months' furlough granted him in Revenue Department Notification No. 113 (Forests), dated the 21st March 1899, on the afternoon of the 14th instant.

17th April 1899.—No. 21.—With reference to Revenue Department Notification No. 114 (Forests), dated the 21st March 1899, Mr. J. Copeland, Deputy Conservator of Forests, made over, and Mr. C. R. Dun, Deputy Conservator of Forests, received charge of the Mandalay Forest division on the afternoon of the 14th instant.

18th April 1899.—No. 186.—Under the provisions of Article 278 of the Civil Service Regulations, privilege leave for 24 days is granted to Mr. H. S. Ker-Edie, Deputy Conservator of Forests, with effect from the 14th April 1899, or the subsequent date on which he may avail himself of it.

18th April 1899.—No. 137.—Mr. M. Hill, Deputy Conservator of Forests, Personal Assistant to the Conservators of Forests, Pegu and Tenasserim Circles, is appointed to the charge of the Rangoon Forest division, in addition to his own duties, during the absence of Mr. Ker-Edie, or until further orders.

18th April 1899.—No. 140.—Mr. C. W. Doveton, Assistant Conservator of Forests, in charge of No. II Working Plans division, is appointed to the charge of the Pynmana Forest division *vice* Mr. S. Carr, transferred.

18th April 1899.—No. 141.—With reference to this department Notification No. 72, dated the 21st February 1899, Mr. S. Carr, Deputy Conservator of Forests, was placed on special duty in the Pynmana division from the 11th to the 16th March 1899, both days inclusive.

18th April 1899.—No. 142.—Under the provisions of article 340 (b) of the Civil Service Regulations, furlough for one year is granted to Mr. T. A. Hauxwell, Deputy Conservator of Forests, with effect from the 30th April 1899, or the subsequent date on which he may avail himself of it.

18th April 1899.—No. 143.—Mr. H. H. Forteath, Deputy Conservator of Forests, is transferred from the Working Plans division, Toungoo, to the charge of the Toungoo forest division, during the absence of Mr. Hauxwell on furlough or until further orders.

20th April 1899.—No. 144.—Mr. O. W. B. Anderson, Extra Assistant Conservator of Forests, was transferred from the charge of the Myadaung sub-division, Katha Forest division, to the charge of the Minbu Forest division, *vice* Mr. C. E. Muriel, who proceeded on leave.

20th April 1899.—No. 145.—Mr. O. W. B. Anderson, Extra Assistant Conservator of Forests, was transferred from the charge of the Minbu Forest division to Port Blair.

This cancels this department Notification No. 92, dated the 9th March 1899.

22nd April 1899.—No. 5.—With reference to Revenue Department Notification No. 91, dated the 9th March 1899, Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, made over, and Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, received charge of the Minbu division on the forenoon of the 15th April 1899.

22nd April 1899.—No. 3.—With reference to Revenue Department Notifications Nos. 136 and 137 (Forests), dated the 18th April 1899, Mr. H. S. Ker-Edie, Deputy Conservator of Forests, was relieved of the charge of the Rangoon Division by Mr. M. Hill, Deputy Conservator of Forests, on the afternoon of the 13th April 1899.

24th April 1899.—No. 4.—With reference to Revenue Department Notification No. 134 (Forests), dated the 13th April 1899, Mr. H. B. Ward, Deputy Conservator of Forests, was relieved of the charge of the Agency Division by Mr. M. Hill, Deputy Conservator of Forests, on the afternoon of the 22nd April 1899.

24th April 1899.—150.—Mr. J. Nisbet, Conservator of Forests, has been granted by Her Majesty's Secretary of State for India, an extension of furlough for six months on medical certificate.

25th April 1899.—No. 152.—Under the provisions of articles 277 and 291 of the Civil Service Regulations, privilege leave for two months and 11 days is granted to Mr. C. E. Muriel, Deputy Conservator of Forests, with effect from the 29th March 1899, the date on which he availed himself of it.

Mr. Muriel is permitted to overstay his leave by 15 days.

This cancels this department Notification No. 110, dated the 17th March 1899.

27th April 1899.—No. 154.—On his return from leave, Mr. E. B. Powell, Extra Assistant Conservator of Forests, is posted to the charge of the Myadaung sub-division of the Katha forest division.

27th April 1899.—No. 155.—Mr. M. Hill, Deputy Conservator of Forests, Personal Assistant to the Conservators of Forests, Pegu and Tenasserim Circles, is appointed to the charge of the Depot and Agency division, Rangoon, *vice* Mr. H. B. Ward, Deputy Conservator of Forests. Mr. Hill will also hold charge of the Rangoon division.

addition to his other duties during the absence of Mr. H. S. Ker-Eddie, Deputy Conservator of Forests on privilege leave, or until further orders.

9.—ASSAM GAZETTE.

10th April 1899.—No. 2488G.—Mr. A. R. Dicks, Assistant Conservator of Forests, on special duty in the Darrang Forest Division, is transferred and attached to the Garo Hills Forest Division.

This cancels Notification No. 89G., dated the 4th January 1899, published at page 2, Part I, of the *Assam Gazette* of the 7th January 1899.

10th April 1899.—No. 2489G.—Mr. J. C. Carroll, Assistant Conservator of Forests, attached to the Garo Hills Forest Division, is transferred and attached to the Sibsaigar Forest Division.

19th April 1899.—No. 2795G.—With effect from the 9th December 1898, in consequence of the transfer from Assam to Burma of Mr. H. S. Ker-Eddie, Assistant Conservator of Forests, First grade, Mr. A. R. Dicks, Officiating Assistant Conservator of Forests, First grade, is confirmed in that grade.

19th April 1899.—No. 2796G.—With effect from the 24th January 1899, in consequence of an existing officiating vacancy in the Fourth grade of Deputy Conservators of Forests, owing to Mr. E. E. Fernandez, Deputy Conservator of Forests, Assam, officiating as Conservator of Forests in the Central Provinces, Mr. W. R. Doxat, Assistant Conservator of Forests, Second grade, is promoted to officiate as Deputy Conservator of Forests, Fourth grade.

10.—HYDERABAD RESIDENCY GAZETTE.

22nd March 1899.—No. 124.—Mr. L. K. Martin, Extra Assistant Conservator of Forests, and Divisional Forest Officer, Akola, has been granted privilege leave for 21 days, with effect from the afternoon of the 18th February 1899.

Mr. V. Krishnaswamy, Forest Ranger, 1st grade, is appointed to be in temporary charge of the Akola Division during Mr. Martin's absence on leave, or until further orders.

24th March 1899.—No. 128.—Mr. R. M. Williamson, officiating Deputy Conservator of Forests, 4th grade, and Divisional Forest Officer, Ellichpur, has been granted six months' special leave on urgent private affairs, with effect from the 18th April 1899, or from such subsequent date as he may avail himself of it.

11.—MYSORE GAZETTE.

12th April 1899.—No. 7141—*Ft. F. 60-95.*—Mr. G. F. Ricketts, Assistant Conservator of Forests, having returned to duty on the forenoon of the 6th March 1899, from the one year's leave on medical certificate granted to him in Government Notification No. 8272—*Ft. F. 60-95*, dated 5th March 1898, the unexpired portion of the leave, viz. five days, is hereby cancelled.

12th April 1899.—No. 7144—*Ft. F. 60-95.*—Mr. G. E. Ricketts, Assistant Conservator of Forests, doing duty in the Conservator's office, is posted to the Kadar district for general forest duty under the orders of the Deputy Conservator.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

18th May 1899.—No. 463-F.—The services of Mr. J. L. Pigot, Deputy Conservator of Forests, Coorg, are placed temporarily at the disposal of the Foreign Department, for employment as Conservator of Forests in the Mysore State, with effect from the 3rd January 1899.

23rd May 1899.—No. 486-F.—With reference to the Notification of this Department No. 378-F., dated the 20th April 1899, Mr. S. Carr, Deputy Conservator of Forests, Burma, is appointed to officiate as Instructor at the Imperial Forest School, Dehra Dun, with effect from the forenoon of the 23rd April 1899.

31st May 1899.—No. 501-F.—Furlough for two years, under article 340 (b) of the Civil Service Regulations, is granted to Mr. E. P. Dansey, Conservator, 1st grade, in charge of the Central Forest Circle, North-Western Provinces and Oudh, with effect from the afternoon of the 24th May 1899.

The following arrangements are made during Mr. Dansey's absence or until further orders :

- (i) Mr. C. G. D. Fordyce, Deputy Conservator, 2nd (officiating 1st) grade, Bengal, to officiate as Conservator, 3rd grade, and to hold charge of the Central Forest Circle in the North-Western Provinces and Oudh, with effect from the afternoon of the 24th May 1899, when he relieved Mr. Dansey of the charge of that Circle.
- (ii) Mr. A. E. Wild, Conservator, 2nd grade, Bengal, to officiate in the 1st grade, with effect from the 25th May 1899.

2.—MADRAS GAZETTE.

1st May 1899.—No. 206.—Appointment :—

No.	Name of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. C.B. Dawson	Assistant Conservator of Forests, 2nd grade.	Assistant Conservator of Forests, 1st grade.	Acting	With effect from 21st September 1898.

2nd May 1899.—*Leave*.—The Board of Revenue has granted, under article 291, Civil Service Regulations, privilege leave for eleven days to Mr. J. S. Scott, Assistant Conservator of Forests, Nellore, with effect from the 5th April 1899.

3rd May 1899.—No. 204.—

No.	Name and designation of officer.	District.	Nature of charge.	Remarks.
1	Mr. S. Cox, Acting Deputy Conservator of Forests, 4th Grade.	...	On special duty for the preparation of working plans or otherwise reporting on the capabilities of the forests for the supply of railway sleepers.	To work under the orders of the Conservator, Northern Circle, with headquarters at Wal-tair.
2	M. R. Ry. T. M. Nallaswami Nayudu, Extra Assistant Conservator of Forests, 2nd grade.	Vizagapa-tam.	Acting District Forest Officer.	As a temporary arrangement.

4th May 1899.—*Leave*.—To M. R. Ry. T. Arumuga Mudaliar, Ranger, 4th grade, North Arcot district, for two months under article 369 of the Civil Service Regulations from date of relief.

4th May 1899.—*Leave*.—Mr. F. S. Brito, Forest Ranger, 6th grade, South Coimbatore Division, is granted leave on medical certificate, under article 369 of the Civil Service Regulations, for three months from 20th April 1899.

5th May 1899.—*Leave*.—M. R. Ry. T. Shanmuga Mudaliar, Ranger, 5th grade, Nellore district, is granted privilege leave under article 291 of the Civil Service Regulations for fifteen days from 11th May 1899.

5th May 1899.—*Promotion ceased*.—The probationary promotion to 5th grade of Forest Ranger M. Balaji Sing ceased from 1st May 1899.

10th May 1899.—No. 212.—The privilege leave for one month granted by the Board of Revenue to M. R. Ry. V. Alwar Chetty Garu, acting District Forest Officer, Trichinopoly, in Notification published at page 451, Part I of the *Fort St. George Gazette* dated 14th March 1899, is extended by eleven days under article 291 of the Civil Service Regulations.

10th May 1899—No. 215.—Appointments.

No.	Name of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
	Mr. J. S. Battie	Deputy Conservator of Forests, 3rd grade.	Deputy Conservator of Forests, 2nd grade.	Acting ...	
	Mr. F. Foulks...	Deputy Conservator of Forests, 4th grade.	Deputy Conservator of Forests, 3rd grade.	Do.	During the absence of Mr. A. W. Lushington on furlough, or until further orders.
	Mr. J. L. MacC. O'Leary	Assistant Conservator of Forests, 1st grade.	Deputy Conservator of Forests, 4th grade.	Do.	

10th May 1899.—No. 215.—Appointments.

No.	Name of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy &c.
4	Mr. E. R. Murray.	Deputy Conservator of Forests, 3rd grade.	Deputy Conservator of Forests, 2nd grade.	Acting.	During the absence of Mr. F. A. Lodge on furlough, or until further orders.
5	Mr. H. B. Bryant.	Deputy Conservator of Forests, 4th grade.	Deputy Conservator of Forests, 3rd grade.	Do.	
6	Mr. H. F. Arbuthnot.	Assistant Conservator of Forests, 2nd grade and acting in the 1st grade.	Deputy Conservator of Forests, 4th grade.	Do.	
7	Mr. J. S. Soot...	Do.	Do.	Do.	
8	Mr. P. M. Lushington.	Deputy Conservator of Forests, 3rd grade.	Deputy Conservator of Forests, 2nd grade.	Do.	During the absence of Mr. J. S. Battle on furlough, or until further orders.
9	Mr. F. C. L. Cowley-Brown	Deputy Conservator of Forests, 4th grade.	Deputy Conservator of Forests, 3rd grade.	Do.*	
10	Mr. J. S. Soot	Assistant Conservator of Forests, 2nd grade.	Deputy Conservator of Forests, 4th grade.	Do.†	

*From the date of his return from furlough.

†From the date of Mr. Tireman's return to duty.

28th May 1899.—*Leave*.—Muhammad Abdul Hakim Sahib, Acting Ranger, 6th grade, Nellore district (under transfer to the North Arcot district), is granted three months leave on medical certificate under article 869 of the Civil Service Regulations from 11th May 1899.

29th May 1899.—*Promotions*.—The following promotions are ordered among Rangers in the Northern Circle with effect from 1st April 1899 :—

K. Aswatham Naidu, from Ranger, Fifth Grade, to Ranger, Fourth Grade, permanent.

V. R. Venkatramiah, from Ranger, Sixth Grade, to Ranger, Fifth Grade, *sub. pro tem*.

D. A. Stracey, from Ranger, Sixth Grade, to Ranger, Fifth Grade, *sub. pro tem*.

3.—BOMBAY GAZETTE.

9th May 1899.—No. 955.—Messrs. W. R. Gowande, Extra Assistant Conservator of Forests, and W. R. Patwardhan, Huzúr Deputy Collector, respectively delivered over and received charge of the Sholapur Division on the afternoon of the 1st May 1899.

18th May 1899.—No. 3871.—Mr. T. B. Fry, Conservator of Forests, Southern Circle, is allowed privilege leave of absence for three months.

15th May 1899.—No. 1052.—Messrs. W. R. Patwardhan, Huzúr Deputy Collector, and O. H. L. Napier, Deputy Conservator of Forests, respectively delivered over and received charge of the Sholapur Division on the forenoon of the 5th May 1899.

16th May 1899.—No. 446.—Messrs. W. A. Wallinger, Extra Assistant Conservator of Forests, First grade and Savliaram Balwant Ranade, L. C. E., Extra Assistant Conservator of Forests, Fourth grade, respectively delivered over and received charge of the Divisional Forest office, Panch Maháls, on the 7th May 1899, in the afternoon.

22nd May 1899.—No. 1022.—Messrs. H. A. Nadkarni and W. A. Wallinger, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the Dharwar Division on the forenoon of the 17th May 1899.

25th May 1899.—No. 3675.—His Excellency the Governor in Council is pleased to make the following appointments during the absence of Mr. T. B. Fry on privilege leave or pending further orders:—

Mr. W. G. Betham to act as Conservator of Forests.

Mr. H. Murray to act as Deputy Conservator of Forests, First grade, and to hold charge of the Southern Circle in addition to his own duties.

31st May 1899.—No. 1218.—Mr. B. G. Deshpande, Extra Assistant Conservator of Forests, delivered over and Mr. D. A. Thomson, acting Deputy Conservator of Forests, received charge of the Sub-Division Forest office, Kolaba, on the afternoon of the 19th May 1899.

No. 1228.—Mr. H. Murray, Deputy Conservator of Forests, delivered over and Mr. H. A. Nadkarni, Extra Assistant Conservator of Forests, received charge of the Sub-Division Forest office, S. D. Kanara, on the forenoon of the 20th May 1899.

4.—BENGAL GAZETTE.

4th May 1899.—No. 1T—R.—Mr. C. C. Hatt, officiating Deputy Conservator of Forests, Puri Forest Division, is granted privilege leave for two months and seventeen days, under articles 277 and 291 of the Civil Service Regulations, with effect from the 2nd May 1899, or such subsequent date as he may avail himself of it.

Mr. P. J. Draper, Ranger, is appointed to hold charge of the Puri Forest Division, during the absence, on leave, of Mr. Hatt, or until further orders.

11th May 1899.—No. 52T.—R.—The services of Mr. C. G. D. Fordyce, Deputy Conservator of Forests, are placed at the disposal of the Government of India, with effect from the date on which he makes over charge of the Sundarbans Forest Division.

N.-W. P. AND OUDH GAZETTE.

10th May 1899.—No. ¹⁷⁴⁸
~~II—86A.~~ The following temporary promotions and reversions in the Forest service are notified for general information :—

Entry No.	With effect from	Consequent on	Name.	From	To
1	8th February 1899.	Mr. B. A. Rebach's reversion as Deputy Conservator, 2nd grade.	Mr. F. B. Bryant	Officiating Deputy Conservator, 1st grade.	Deputy Conservator, 2nd grade.
2	7th April 1899.	Mr. N. Hearle's appointment as officiating Conservator, 3rd grade, in the Central Provinces.	„ F. B. Bryant	Deputy Conservator, 2nd grade.	Officiating Deputy Conservator, 1st grade.
			„ B. A. Rebach	Deputy Cons. 2nd grade, provisionally substantive.	Officiating Deputy Conservator, 1st grade.
			„ L. Mercer ..	Deputy Cons. 3rd grade, provisionally substantive.	Officiating Deputy Conservator, 2nd grade.
			„ P. H. Clutterbuck.	Deputy Conservator, 4th grade.	Officiating Deputy Conservator, 3rd grade.
			„ J. C. Tulloch	Assistant Conservator, 1st grade.	Officiating Deputy Conservator, 4th grade.
			„ F. F. R. Chan- ner.	Assistant Conservator, 2nd grade.	Officiating Assistant Conservator, 1st grade.

5.—PUNJAB GAZETTE.

11th May 1899.—No. ²³⁰ A. L. No. 14. The following changes have

taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified against each :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	Remarks.
Mr. G. F. Provost	Provisional Deputy Conservator, 1st grade, and offg. Conservator.	Deputy Conservator, 1st grade, and officiating Conservator.	16th February 1899	Consequent on the death of Mr. W. P. Thomas.
Mr. W. King ...	Offg. Deputy Conservator, 1st grade.	Provisional Deputy Conservator, 1st grade.	Ditto	
Mr. F. S. Barker.	Provisional Deputy Conservator, 2nd grade.	Deputy Conservator, 2nd grade.	Ditto	
Mr. G. T. Taylor.	Offg. Deputy Conservator, 2nd grade.	Provisional Deputy Conservator, 2nd grade.	Ditto	
Mr. G. S. Hart...	Provisional Deputy Conservator, 3rd grade.	Deputy Conservator, 3rd grade.	Ditto	
Mr. C. P. Fisher.	Offg. Deputy Conservator, 3rd grade.	Provisional Deputy Conservator, 3rd grade.	Ditto	
Mr. E. M. Coventry.	Provisional Deputy Conservator, 4th grade.	Deputy Conservator, 4th grade.	Ditto	
Mr. R. M. Williams.	Offg. Deputy Conservator, 4th grade.	Provisional Deputy Conservator, 4th grade.	Ditto	
Mr. W. Mayes...	Provisional Assistant Conservator, 1st grade.	Assistant Conservator, 1st grade, and Offg. Deputy Conservator, 4th grade.	Ditto	
Mr. C. M. McCrie	Offg. Deputy Conservator, 4th grade.	Assistant Conservator, 1st grade.	Ditto	
Mr. H. E. Bartlett	Offg. Assistant Conservator, 1st grade.	Provisional Assistant Conservator, 1st grade.	Ditto	
Mr. G. S. Hart...	Deputy Conservator, 3rd grade.	Offg. Deputy Conservator, 2nd grade.	22nd March 1899.	Consequent on the departure of Mr. L. Gisborne Smith on leave on Medical certificate.
Mr. A. W. Blunt.	Deputy Conservator, 4th grade.	Offg. Deputy Conservator, 3rd grade.	Ditto	
Mr. S. L. Kenny.	Provisional Assistant Conservator, 1st grade.	Deputy Conservator, 4th grade.	Ditto	
Mr. S. L. Kenny.	Offg. Deputy Conservator, 4th grade.	Provisional Assistant Conservator, 1st grade.	4th March 1899.	Consequent on the return of Mr. H. M. Long from leave on Medical certificate.

11th May, 1899.—No. $\frac{284}{102}$ A. L. No. 15.—*Addendum*.—In Notification No. $\frac{102}{102}$ A. L. No. 8, dated 27th February 1899, opposite the remark consequent on the departure of Mr. H. A. Hoghton on privilege leave, between Mr. E. M. Coventry and Mr. R. S. Hole, add in the first column "Mr. S. L. Kenny," in the second column "Provisional Assistant Conservator, 1st grade," in the 3rd column "officiating Deputy Conservator, 4th grade," and in the 4th and 5th columns "*ditto*."

11th May 1899.—No. $\frac{388}{166}$ A. L. No. 16.—*Erratum*.—In Notification No. $\frac{166}{166}$ A. L. No. 11, dated 4th April 1899, opposite Mr. S. L. Kenny, in two places, instead of "officiating Assistant Conservator" read "Provisional Assistant Conservator."

Opposite the remark consequent on the departure of Mr. F. O. Lemarchand on furlough, instead of "Mr. W. Mayes" read "Mr C. M. McCrie," and in the column "present grade," read "Assistant Conservator" instead of "Provisional Assistant Conservator," and in column "with effect from" read "6th March 1899" instead of "6th February 1899."

11th May 1899.—No. $\frac{242}{184}$ A. L. No. 17.—*Erratum*.—In Notification No. $\frac{184}{184}$ A. L. No. 13, dated 18th April 1899, in the column "with effect from" read "28th November 1898" instead of "27th November 1898."

7.—CENTRAL PROVINCES.

25th April 1899.—No. 2.—Temporary Deputy Ranger Rajendra Lal Shawe on return from the leave granted him by the following Notifications is transferred to the Nimar Forest Division :—

No. 2, dated the 14th April 1898.

No. 38, dated the 21st September 1898.

No. 32, dated the 24th September 1898.

No. 42, dated the 30th November 1898.

1st May 1899.—No. 3.—Privilege leave for 25 days, under article 291 of the Civil Service Regulations, is granted to Shri Deo Bajpai, Ranger, 5th grade, Permanent Establishment, Mandla Forest Division, with effect from the 1st May 1899, or such subsequent date as he may be permitted to avail himself of it.

4th May 1899.—No. 4.—Privilege leave for seventeen days, under article 291 of the Civil Service Regulations, is granted to Bhaya Lal, Ranger, 4th grade, Permanent Establishment, Nimar Forest Division, in continuation of the two months' privilege leave granted to him by Departmental Order No. 48, dated the 14th February 1899.

8th May 1899.—No. 5.—Leave on medical certificate for one month and five days, under article 369 of the Civil Service Regulations, was granted to Dhondu Narayan, Forest Ranger, Permanent Establishment, Hoshangabad Forest Division, with effect from the 8th March 1899.

9th May 1899.—Leave without pay for three months and nine days, under article 372 of the Civil Service Regulations, was granted to Rajendra Lal Shawe, Deputy Ranger, Temporary Establishment,

Jubbulpore Forest Division, in continuation of the 10 months' leave without pay granted to him by the following Departmental Notifications :—

No. 2, dated the 14th April 1898.

No. 32, dated the 24th September 1898.

No. 42, dated the 30th November 1898.

13th May 1899.—No. 6.—Leave on medical certificate for fifteen days, under article 369 of the Civil Service Regulations, is granted to Bastiram, Deputy Ranger, Permanent Establishment, Betul Forest Division, in continuation of the two months' leave on medical certificate granted him by Departmental Order No. 1, dated the 5th April 1899.

31st May 1899.—No. 2187.—On completion of his special duty in the Mandla Forest Division, Mr. R. C. Thompson, Extra Assistant Conservator of Forests, is transferred to the Direction Division, Northern Circle.

8.—BURMA GAZETTE.

29th April 1899.—No. 5.—Mr. M. Hill, Deputy Conservator of Forests, was relieved of the duties of Personal Assistant to the Conservator of Forests, Pegu Circle, on the forenoon of the 22nd April 1899, on which date he assumed charge of the Agency division in addition to the Rangoon division.

29th April 1899.—No. 6.—Mr. A. Rodger, Assistant Conservator of Forests, was relieved of his duties in the Tharrawaddy division on the forenoon of the 25th April 1899, on transfer to the Prome division, which he joined on the same day.

29th April 1899.—No. 7.—Mr. J. L. Hefferman, Extra Assistant Conservator of Forests, was relieved of his duties in the Prome division on the 24th April 1899, and held charge of the Thayetmyo division from the afternoon of the 25th to the afternoon of the 27th April 1899 and proceeded on leave of absence (on medical certificate) on the last-mentioned date.

2nd May 1899.—No. 159.—Under the provisions of article 291 of the Civil Service Regulations, privilege leave for three months is granted Mr. J. L. Hefferman, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

2nd May 1899.—No. 160.—Under the provisions of Article 282 (i) of the Civil Service Regulations, privilege leave for three months and 16 days is granted to Mr. A. E. Ross, officiating Deputy Conservator of Forests, with effect from the 12th May 1899, or the subsequent date on which he may avail himself of it.

9th May 1899.—No. 8.—Mr. C. L. Toussaint, Deputy Conservator of Forests, assumed charge of the Thayetmyo Forest division, in addition to his other duties, on the afternoon of the 5th May 1899.

9th May 1899.—No. 9.—Mr. M. Hill, Deputy Conservator of Forests, was relieved of the charge of the Rangoon Division by Mr. H. S. Ker-Eddie, Deputy Conservator of Forests, on the forenoon of the 8th May 1899.

9th May 1899.—No. 2.—With reference to Revenue Department Notification No. 142 (Forests), dated the 19th April 1899, Mr T. A. Hauxwell, Deputy Conservator of Forests, made over, and Mr. H. H. Forteath, Deputy Conservator of Forests, received charge of the Toungoo division on the forenoon of the 1st May 1899.

12th May 1899.—No. 167.—Mr. S. F. L. Cappel, Assistant Conservator of Forests, is posted to the charge of the Shwegyin Forest division, during the absence of Mr. A. E. Ross, officiating Deputy Conservator of Forests, on privilege leave, or until further orders.

12th May 1899.—No. 168.—Mr. H. W. A. Watson, Assistant Conservator of Forests, is posted to the charge of the Toungoo sub-division, Toungoo Forest division.

12th May 1899.—No. 10.—Mr. C. L. Toussaint, Deputy Conservator of Forests, was relieved of the charge of the Pegu division by Mr. W. T. T. McHarg, Deputy Conservator of Forests, on the afternoon of the 10th May 1899.

15th May 1899.—No. 169.—Mr. W. T. T. McHarg, Deputy Conservator of Forests, is transferred from the Ruby Mines Forest division and is posted to the charge of the Pegu Forest division.

15th May 1899.—No. 170.—Mr. C. L. Toussaint, Deputy Conservator of Forests, is transferred from Pegu to the charge of the Thayetmyo Forest division.

15th May 1899.—No. 171.—Under the provisions of article 282 (i) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. H. B. Anthony, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

15th May 1899.—No. 172.—Mr. G. R. Long, Deputy Conservator of Forests, is appointed temporarily to the charge of the Thaungyin Forest division, in addition to his other duties, during the absence of Mr. H. B. Anthony on privilege leave or until further orders.

17th May 1899.—No. 175.—In supersession of this department Notification No. 140 (Forests), dated the 19th April 1899, Mr. G. E. S. Cubitt, officiating Deputy Conservator of Forests, was placed in charge of the Pyinmana Forest division from the afternoon of the 16th April till the afternoon of the 24th April 1899, *vice* Mr. S. Carr, Deputy Conservator of Forests, transferred.

17th May 1899.—No. 176.—Mr. C. W. Doveton, officiating Deputy Conservator of Forests, was appointed to the charge of the Pyinmana Forest division from the afternoon of the 24th April 1899, *vice* Mr. G. E. S. Cubitt, officiating Deputy Conservator of Forests, who reverted to duty in the Pyinmana Forest division.

17th May 1899.—No. 182.—Mr. E. M. Buchanan, Extra Deputy Conservator of Forests, is transferred from Mingin to Rangoon on special duty under the orders of the Conservator of Forests, Pegu Circle, in connection with the Tharrawaddy Forest School.

17th May 1899.—No. 183.—Mr. H. Jackson, Deputy Conservator of Forests, is appointed to the charge of the Myitha Forest division in addition to his other duties.

17th May 1899.—No. 184.—Mr. A. H. M. Lawson, Assistant Conservator of Forests, is transferred from Bhamo to duty in the Mandalay Forest division.

18th May 1899.—No. 3.—With reference to Revenue Department Notification No. 166 (Forests), dated the 2nd May 1899, Mr. A. E. Ross,

officiating Deputy Conservator of Forests, Shwegyin division, made over, and Mr. E. Fowle, Sub-divisional Officer, Shwegyin, received charge of the Shwegyin division on the afternoon of the 11th May 1899.

20th May 1899.—No. 4.—With reference to Revenue Department Notification No. 167 (Forests), dated the 12th May 1899, Mr. E. Fowle, Sub-divisional Officer, made over, and Mr. S. F. L. Cappel, Assistant Conservator of Forests, received charge of the Shwegyin division on the forenoon of the 17th May 1899.

22nd May 1899.—No. 22.—With reference to Revenue Department Notification No. 169 (Forests), dated the 15th May 1899, Mr. W. T. McHarg, Deputy Conservator of Forests, relinquished charge of his duties as special Girdling Officer in the Ruby Mines division on the afternoon of the 4th instant.

25th May 1899.—No. 23.—Mr. E. B. Powell, Extra Assistant Conservator of Forests, reported his arrival from the three month's privilege leave granted him in Revenue Department Notification No. 21 (Forests), dated the 16th January 1899, on the afternoon of the 2nd May 1899.

25th May 1899.—No. 24.—With reference to Revenue Department Notification No. 154 (Forests) dated the 27th April 1899, Mr. H. Mc. L. Carson, Forest Ranger, made over, and Mr. E. B. Powell, Extra Assistant Conservator of Forests, received charge of the Myadaung sub-division of the Katha Forest division on the forenoon of the 13th May 1899.

26th May 1899.—No. 11.—Mr. W. T. T. McHarg, Deputy Conservator of Forests, was relieved of the charge of the Pegu division by Mr. C. W. Allan, Extra Deputy Conservator of Forests, on the forenoon of the 25th May 1899.

26th May 1899.—No. 25.—With reference to Revenue Department Notification No. 175 (Forests), dated the 17th May 1899, Mr. S. Carr, Deputy Conservator of Forests, made over, and Mr. G. E. S. Oubitt, officiating Deputy Conservator of Forests, received charge of the Pynmana Forest Division on the afternoon of the 16th April 1899.

26th May 1899.—No. 26.—With reference to Revenue Department Notification No. 176 (Forests), dated the 17th May 1899, Mr. G. E. S. Oubitt, officiating Deputy Conservator of Forests, made over, and Mr. C. W. Doveton, officiating Deputy Conservator of Forests, received charge of the Pynmana Forest division on the afternoon of the 24th April 1899.

29th May 1899.—No. 192.—Under the provisions of article 340 (b) of the Civil Service Regulations, furlough for 18 months is granted to Mr. W. T. T. McHarg, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

29th May 1899.—No. 193.—On return from furlough Mr. C. W. Allan, Extra Deputy Conservator of Forests, is posted to the charge of the Pegu Forest division.

9.—ASSAM GAZETTE.

29th May 1899.—No. 3865G.—The following Notification by the Government of India in the Department of Revenue and Agriculture is republished :

No. 463 F, dated Simla, the 18th May 1899.—The services of Mr. J. L. Pigot, Deputy Conservator of Forests, Coorg, are placed temporarily at the disposal of the Foreign Department, for employment as Conservator of Forests in the Mysore State, with effect from the 3rd January 1899.

30th May 1899—No. 8919G.—Privilege leave of absence for six weeks, under article 291 of the Civil Service Regulations, is granted to Babu Kripanath De, Extra Assistant Conservator of Forests, Sylhet, with effect from the 20th May 1899, or the subsequent date on which he may avail himself of it.

30th May 1899—No. 8920G.—Mr. J. E. Barrett, Deputy Conservator of Forests in charge of the Cachar Forest Division, is placed in charge of the Sylhet Forest Division, in addition to his own duties, during the absence on leave of Babu Kripanath De, or until further orders.

10.—HYDERABAD RESIDENCY GAZETTE.

2nd May 1899—No. 197.—The Resident at Hyderabad is pleased to invest Mr. W. G. Peake, an Extra Assistant Conservator of Forests in the Hyderabad Assigned Districts, with all the powers described in section 36 (1) of the Berar Forest Law, 1886, as amended by the Berar Forest Law Amendment Law, 1891.

2nd May 1899—No. 198.—The Resident at Hyderabad is pleased to invest Mr. S. L. Kenny, an Assistant Conservator of Forests in the Hyderabad Assigned Districts, with the powers described in section 36 (1) (e) of the Berar Forest Law, 1886, as amended by the Berar Forest Law Amendment Law, 1891.

11.—MYSORE GAZETTE.

2nd May 1899—No. 7987.—*Pt. F.* 43-96—Under Article 188 of the Mysore Service Regulations, Mr. H. Srinivasa Row, Acting Sub-Assistant Conservator of Forests, Mysore district, is granted privilege leave of absence for sixteen days with effect from the 2nd May 1899 or such other date as he may avail himself of the same.

15th May 1899—No. 8355.—*Pt. F.* 46-96—Under Article 188 of the Mysore Service Regulations, Mr. B. Hira Singh, Assistant Conservator of Forests Kadur district, is granted privilege leave of absence for one month with effect from the 16th May 1899, on which date Mr. G. E. Ricketts will relieve him as District Forest Officer.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

3rd June 1899.—No. 15. I. E.—His Excellency the Grand Master of the Most Eminent order of the Indian Empire is pleased to announce that Her Majesty the Queen, Empress of India, has been graciously pleased to make the following appointments to the said order:—

To be Companions.

* * *

James Sykes Gamble Esquire, lately Conservator of Forests and Director of the Imperial Forest School at Dehra Dun.

3rd June 1899.—No. 1462-I. A.—His Excellency the Viceroy and Governor-General is pleased to confer the title of Rai Bahadur as a personal distinction upon

* * *

Manepanda Muttanah, Extra Deputy Conservator of Forests, Madras.

14th June 1899.—No. 549-F.—The following transfers have been ordered in the interests of the public service :

(i) Mr. C. Somers-Smith, Deputy Conservator of Forests, Punjab, to the Central Provinces.

(ii) Mr. M. Mutannah, Extra-Deputy Conservator, Central Provinces—to the Madras Presidency.

23rd June, 1899.—No. 576-F.—With reference to the Notification of this Department No. 1984 (General), dated the 16th instant, Mr. J. W. Oliver, Conservator of Forests, 2nd grade, is appointed, on return from furlough, to officiate in the 1st grade of Conservators and, to hold charge of the School Forest Circle in the North-Western Provinces and Oudh and of the Imperial Forest School at Dehra Dun, while Mr. H. C. Hill officiates as Inspector-General of Forests, or until further orders.

2.—MADRAS GAZETTE,

3rd June 1899.—*Leave.*—M. R. Ry. A. N. Venkateshchellam Chetty Ranger, 5th grade, Trichinopoly district, is granted privilege leave under article 291 of the Civil Service Regulations for fifteen days from date of relief.

Leave.—Saiyid Burhan-ud-din Sahib, Ranger, 2nd grade, Salem district, is granted privilege leave under article 291 of the Civil Service Regulations, for two months from 1st June 1899 or from date of relief.

4th June 1899.—*Privilege leave.*—To M. R. Ry. N. Arumuga Mudaliar, Ranger, 3rd grade, Chingleput district, for fifteen days under article 291 of the Civil Service Regulations in continuation of the leave already granted to him.

8th June 1899.—*Leave.*—M. R. Ry. B. Sama Row, Ranger, 5th grade, Cuddapah district, is granted privilege leave under article 291 of the Civil Service Regulations, for fifteen days from date of relief.

9th June 1899.—*Promotions.*—The following promotions in the Rangers' class are ordered with effect from 1st April 1899:—

Names.	District to which attached,	Present grade.	Grade to which promoted.	Nature of promotion.
M. R. Ry. T. Bapu Rao.	Ouddapah (under transfer to Ohing-leput.)	2nd Grade	1st Grade	Permanent.
Mr. J. Tapp	On foreign service in Jeypore.	3rd „ „	2nd „ „	Do.
Salyid Burhan-ud-din Sahib.	Salem „	3rd „ „	2nd „ „	Do.
Mr. J. A. Daly	Do. „	3rd „ „	2nd „ „	Acting sub <i>pro tem.</i> vice Mr. J. Tapp.
M. R. Ry. T. Arumuga Mudaliar.	North Arcot „	4th „ „	3rd „ „	Permanent.
„ T. Shanmuga Mudaliar.	Nellore „	5th „ „	4th „ „	Do.
„ A. N. Venkatachellam, Chetty.	Trichinopoly „	6th „ „	5th „ „	Do.
Mr. D. J. Evers	Salem „	6th „ „	5th „ „	

9th June 1899.—*Promotions.*—The following promotions are ordered in the Rangers' class of the Southern Circle with effect from 1st April 1899.

Name.	Present grade.	Grade to which promoted.	Nature of promotion.
O. S. Venkatramana Aiyar	Ranger, 5th...	Ranger, 4th...	Permanent.
K. Gajaraju Mudaliar	Do. 6th...	Do. 5th...	Do.
V. Raman Menon	Do. 6th...	Do. 5th...	Do.
M. Srinivasa	Do. 6th...	Do. 5th...	Do.

Appointment.—Mr. L. S. Janes, Deputy Ranger, I, and sub. *pro tem.* Ranger, 6th grade, to be Ranger, 6th grade, with effect from 1st April 1899.

10th June 1899.—*Leave.*—M. R. Ry. C. Ramaswami Aiyanger, Acting Ranger, 6th grade, Cuddapah district, is granted privilege leave under article 291 of the Civil Service Regulations for one month from 15 June 1899 or from date of relief.

10th June 1899.—*Leave.*—M. R. Ry. O. S. Venkatramanah, Forest Ranger, 5th grade, North Malabar Division, is granted privilege leave for fifty days under article 291 of the Civil Service Regulations from or after 15th June 1899.

10th June 1899.—*Leave.*—M. R. Ry. T. Srinivasa Pillai, Manager, Office of Conservator of Forests, Central Circle, is granted privilege leave, under article 291 of the Civil Service Regulations, for eighteen days from 21st June 1899.

12th June 1899.—*Leave*.—M. R. Ry. S. Kuppuswami Chetti, Forest Ranger 5th grade, Madura district, is granted privilege leave under article 291 of the Civil Service Regulations for one month from or after 10th June 1899.

15th June 1899.—*Sub. pro tem. promotion*.—The promotion of Mr. D. J. Evers, Ranger in the Salem district, from 6th to 5th grade, notified on page 819 of Part II of the *Fort St. George Gazette* dated 13th June 1899, is only *sub. pro tem*.

17th June 1899.—*Leave*.—M.R Ry. R. Srinivasa Raghavachari, Acting Ranger, 6th grade, Chinglepnt district (under transfer to the Trichinopoly district, will be considered to have been on privilege leave under article 291) of the Civil Service Regulations for fifteen days from 14th to 28th May 1899.

19th June 1899.—*Leave*.—M. R. Ry. P. Venkatakistnama Naidu, Forest Ranger, 5th grade, South Canara district, is granted privilege leave on medical certificate under article 291 of the Civil Service Regulations for one month from 7th June 1899.

19th June 1899.—*No. 271*.—Mr. T. N. Hearsey, Extra Assistant Conservator of Forests, Ganjam, is granted privilege leave for one month and fifteen days, to have retrospective effect from 1st April 1899, under article 291 of the Civil Service Regulations.

22nd June 1899. *No. 275*.—*Appointments*.

No.	Name of officer.	Present grade	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. T. N. Hearsey,	Extra Assistant Conservator of Forests, 3rd grade.	Extra Assistant Conservator of Forests, 2nd grade.	Permanent.	Vice M. R. Ry. V. Alwar Chetti Garu whose services have been transferred to the Cochin State.
2	Mr. T.G.A. Gaudoin,	Extra Assistant Conservator of Forests, 4th grade.	Extra Assistant Conservator of Forests, 3rd grade.	Do.	Vice No. 1.
3	M. R. Ry. T. Bapu Rao.	Forest Ranger, 1st Grade, Central Circle.	Extra Assistant Conservator of Forests, 4th grade.	Do.	Vice No. 2.

22nd June. 1899.—*Extension of leave*—The six months' leave on medical certificate under article 369 of the Civil Service Regulations, notified on page 1248, Part II of the *Fort St. George Gazette* dated 20th September 1898, as having been granted to Mr. C. P. Howell, Forest Ranger, 1st grade, South Coimbatore Division, is extended by three months and fifteen days.

28th June 1899.—No. 289.—*Postings.*

No.	Name of officer.	District.	Nature of charge.	Remarks.
1	Mr. J. S. Battle ...	Kurnool ...	District Forest Officer.	
2	Mr. F. C. L. Cowley Brown.	Do.	Acting District Forest Officer.	To join on return from furlough.

30th June 1899. No. 287. *Appointment.*—The services of Mr. R. McIntosh, Deputy Conservator of Forests in the Madras Presidency, have been temporarily placed at the disposal of the Government of India for employment as Instructor, Imperial Forest School, Dehra Dun.

30th June 1899.—No. 292.—*Postings.*

No.	Name of officer.	District.	Nature of charge.	Remarks.
1	Mr. H. A. Latham,	South Canara	Acting District Forest Officer.	To join when directed by the Conservator.
2	Mr. H. F. Arbuthnot,	The Nilgiris.	To work under the orders of the District Forest Officer.	To join on return from leave.

3—BOMBAY GAZETTE.

3rd June 1899.—No. 1284.—Messrs. V. D. P. Rebeiro and B. G. Deshpande, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the Bijapur Forest Division, on the forenoon of the 26th May 1899.

5th June 1899. No. 3899.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. F. Gleadow to be Deputy Conservator of Forests, Second Grade, vice Mr. W. R. Woodrow, retired.

Mr. Gleadow's lien to be suspended, and

Mr. H. Murray to be Deputy Conservator of Forests, Second Grade.

Mr. L. S. Osmaston to be Deputy Conservator of Forests, Third Grade.

Mr. W. E. Copleston to be Deputy Conservator of Forests, Fourth Grade.

6th June 1899. No. 620.—Mr. G. M. Ryan, Deputy Conservator of Forests, Third Grade was relieved by undersigned of the charge of the office of the Conservator of Forests, N. C., on the 3rd June 1899, before noon.

9th June 1899. No. 672.—Messrs. S. B. Ranade, L.C.E., Extra Assistant Conservator of Forests, Fourth Grade, and V. D. P. Rebeiro L.C.E., Extra Assistant Conservator of Forests, Second Grade, respectively delivered over and received charge of the Divisional Forest Office, Panch Mahals, on the 31st May 1899, in the forenoon.

19th June 1899. No. 1513.—Messrs. O. H. L. Napier, Deputy Conservator of Forests, and G. H. Takle, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Sholapur Division on the forenoon of the 9th June 1899.

Bombay Castle 22nd June 1899. No. 4322.—Mr. W. E. Copleston, Deputy Conservator of Forests, Fourth Grade, and Divisional Forest Officer, Belgaum, is allowed privilege leave of absence for three months.

23rd June 1899.—No. 4339.—Mr. A. G. Edie, Divisional Forest Officer, North Thana, is allowed privilege leave of absence for three months.

20th June 1899.—No. 4389. A.—His Excellency the Governor in Council is pleased to appoint Mr. J. Dodgson to act as Divisional Forest Officer, North Thana in addition to his own duties, during the absence on leave of Mr. A. G. Edie or pending further orders.

29th June 1899. No. 4504.—His Excellency the Governor in Council is pleased to appoint Mr. E. G. Oliver to act as Divisional Forest Officer, Belgaum, in addition to his own duties, during the absence on leave of Mr. W. E. Copleston or pending further orders.

4.—BENGAL GAZETTE.

12th June 1899.—No. 670A.D.—The report of the Central Examination Committee having been received, the result of the half-yearly departmental examination of Assistant Magistrates and others, held on the 8th May 1899 and the two following days, is published for general information :—

The following Forest Officers have passed in the subject or subjects mentioned opposite their names :—

- | | |
|-----------------------------|--|
| 1. Mr. T. H. Monteath | ... Bengali by both standards. |
| 2. Babu Guru Das Chatterjee | ... Land Revenue Systems. |
| 3. Mr. J. P. Gregson, | ... Forest Law, Land Revenue Systems, and Bengali by the lower standard. |

4. Babu Ashutosh Churkerbutty Forest Law.

15th June 1899.—No. 524T.—R.—Consequent on the departure of Mr. C. G. D. Fordyce, Officiating Deputy Conservator of Forests, first grade, on privilege leave granted him in Notification No. 1539, dated 11th April 1899, Mr. E. P. Stebbing, Assistant Conservator of Forests, first grade, is promoted to officiate in the fourth grade of Deputy Conservators from the 22nd April 1899.

15th June 1899.—No. 525T.—R.—Consequent on the departure of Mr. C. O. Hatt, Assistant Conservator of Forests, first grade, and Officiating Deputy Conservator, fourth grade, on privilege leave granted him in Notification No. 1T,—R., dated the 4th May 1899, Mr. J. W. A. Grieve, Assistant Conservator of Forests, second grade, and officiating in the first grade, is appointed to officiate in the fourth grade of

Deputy Conservators from the 2nd May 1899, but will revert to the first grade of Assistant Conservator from the 9th idem owing to the return of Mr. Fordyce from privilege leave.

15th June 1899.—No. 526T.—R.—Consequent on the services of Mr. C. G. D. Fordyce, Deputy Conservator, second grade, and officiating in the first grade, having been placed at the disposal of the Government of India, the following temporary promotions are ordered, with effect from the 17th May 1899 :—

Mr. W. M. Green, Deputy Conservator, third grade, and officiating second grade, to officiate in the first grade of Deputy Conservators.

Mr. H. D. D. French, Deputy Conservator, fourth grade, and officiating third grade, to officiate in the second grade.

Mr. H. H. Haines, F.C.S., Deputy Conservator, fourth grade, to officiate in the third grade

Mr. J. W. A. Grieve, Assistant Conservator, second grade, and officiating first grade to officiate in the fourth grade of Deputy Conservators.

26th June 1899.—No. 688T.—R.—Mr. J. W. A. Grieve, Assistant Conservator of Forests, in charge of the Buxa Division, is granted privilege leave for three months, under articles 277 and 291 of the Civil Service Regulations, from the 15th July 1899, or such subsequent date as he may avail himself of it.

Mr. T. H. Monteath, Assistant Conservator of Forests, attached to the Darjeeling Division, is placed in charge of the Buxa Forest Division, during the absence on leave, of Mr. Grieve, or until further orders.

26th June 1899.—No. 689T.—R.—Mr. R. G. A. Hannah, Officiating Extra Assistant Conservator of Forests, attached to the Singhbhum Forest Division, is granted privilege leave for one month, under articles 277 and 291 of the Civil Service Regulations, with effect from the 4th May 1899,

28th June 1899.—No. 732T.—R.—Mr. H. D. D. French, Deputy Conservator of Forests, Sonthal Parganas Forest Division, is granted privilege leave for two months and twenty-eight days under articles 277 and 291 of the Civil Service Regulations, with effect from the 10th August 1899, or such subsequent date as he may avail himself of it.

28th June 1899.—No. 755T.—R.—The Lieutenant-Governor is pleased to appoint, during the absence on privilege leave of Mr. H. D. D. French, Deputy Conservator of Forests, in charge of the Sonthal Parganas Forest Division, or until further orders, each of the Subdivisional Officers of Godda, Rajmahal, Pakaur and Dumka, in the District of the Sonthal Parganas, to be a "Forest Officer" under section 2 of the Indian Forest Act, VII of 1878.

5.—N.-W. P. AND OUDH GAZETTE.

9th June 1899.—No. ²⁰⁹²II.—83C.—Mr. L. Mercer, Deputy Conservator of Forests, Central Circle, privilege leave for three months with effect from the 26th June 1899.

9th June 1899.—No. ²⁰⁹³II.—89C.—Babu Nand Mal, Extra Assistant Conservator of Forests, attached to the Ganges Division of the

Central Circle, to hold charge of the Garhwal Division of the same circle, *vice* Mr. L. Mercer, granted leave.

16th June 1899.—No. $\frac{2184}{\text{II.—349C.}}$.—Mr. F. A. Leet, officiating Deputy Conservator of Forests, in charge of the Bahraich Forest Division of the Oudh Circle, privilege leave for one month with effect from the 25th June 1899.

16th June 1899.—No. $\frac{2185}{\text{II.—349C.}}$.—Mr. F. F. W. Channer, Assistant Conservator of Forests in charge of the Gonda Forest Division of the Oudh Circle, to hold charge of the Bahraich Forest Division of the same circle in addition to his other duties during the absence on leave of Mr. F. A. Leete.

20th June 1899.—No. $\frac{2222}{\text{XIV.—673C.}}$.—Mr. J. C. Tulloch, officiating Deputy Conservator of Forests, in charge of the Kheri Forest Division of the Oudh Circle, privilege leave for three months with effect from the 24th July 1899.

20th June 1899.—No. $\frac{2223}{\text{XIV.—673C.}}$.—Mr. F. A. Leete, officiating Deputy Conservator of Forests, in charge of the Bahraich Forest Division of the Oudh Circle, to hold charge of the Kheri Forest Division of the same circle, in addition to his other duties, during the absence on leave of Mr. J. C. Tulloch.

21st June 1899.—No. $\frac{2267}{\text{II.—181C.}}$.—Lala Permaishri Din, Extra Assistant Conservator of Forests, attached to the Kheri Division of the Oudh Forest Circle, privilege leave for two months with effect from 8th July 1899.

6.—PUNJAB GAZETTE.

16th June 1899.—No. $\frac{276}{\text{A. L. No. 18.}}$.—The following changes have taken place in the List of Forest Officers in the Associated Provinces with effect from the dates specified against each.

Name.	Present grade.	Grade to which promoted or reverted.	With effect from	Remarks.
Mr. H. E. Bartlett,	Offg. Assistant Conservator, 1st grade.	Assistant Conservator 2nd grade.	9th August 1899.	Consequent on his departure on medical leave.
Mr. H. E. Bartlett,	Assistant Conservator, 2nd grade.	Offg. Assistant Conservator, 1st grade.	30th December 1899.	Consequent on his return from medical leave.

7.—CENTRAL PROVINCES GAZETTE.

30th May 1899.—No. 7.—Govind Gangadhar Sapre, who was appointed a probationary Forest Ranger, 6th grade, by Department Order No. 2, dated the 12th April 1898, is confirmed in that grade, with effect from the 1st April 1899.

30th May 1899.—No. 8.—Sukhdeo Rai, Forester, 1st grade, Nimar Division, is promoted to Deputy Ranger, 2nd grade, with effect from the 1st May 1899,

31st May 1899.—No. 9.—Under the authority conferred by Section 31, clause (1), of the Forest Department Code, Abdul-Jalil Siddiki, who was deputed as a stipendiary student to the Imperial Forest School, Dehra Dun, under Rule 8 of the admission rules printed as Appendix II to the Forest Department Code, and who has obtained a certificate by the Higher Standard of the School, is appointed, on probation, as a Ranger of the 6th grade, with effect from the 14th April 1899.

3rd June 1899.—No. 10.—Leave without pay for two years, under article 372 of the Civil Service Regulations, is granted to Rajendra Lal Shawa, Deputy Ranger, Temporary Establishment, Nimar Division, with effect from the 15th June 1899.

13th June 1899.—No. 12.—The following promotions of members of the out-door staff in the Northern Circle, Central Provinces, are ordered with effect from the date specified against each :—

Division.	Name.	Present grade.	Grade to which promoted.	With effect from	Remarks.
Mandla ...	Muhammed Panna.	Forester 1st, grade.	Officiating Deputy Ranger, 2nd grade.	4th June 1899.	On retirement of Ranger Muhammed Yasin.
Narsinghpur,	Amin Chand.	Deputy Ranger, 2nd grade., sub. <i>pro tem.</i>	Deputy Ranger, 2nd grade.	1st July 1899	To fill an existing vacancy.
Damoh	Amir Khan,	Forester, 1st grade	Officiating Deputy Ranger, 2nd grade.	1st July 1899	To fill an existing vacancy.

13th June 1899.—No. 13.—The following transfers of members of the out-door staff are ordered with immediate effect :—

Mr. Bhaya Lal, Ranger, 4th grade, from Khandwa Range, Nimar Division, to the Bargi Range, in the Jubbulpore Division.

16th June 1899.—No. 14.—Consequent on the retirement, on the 4th June 1899, of Muhammed Yasin, Ranger, 3rd grade, the following promotions are ordered with effect from that date :—

Mr. R N. Thompson, Ranger, 3rd grade, sub. *pro tem.*, to be confirmed in that grade.

Mr. W. J. Anthony, Ranger, 4th grade, to be Ranger, 3rd grade, sub. *pro tem.*

Mr. W. J. Slauey, Ranger, 4th grade, sub. *pro tem.*, is confirmed in that grade.

Shyam Sundar Lal, Ranger, 5th grade, to be Ranger, 4th grade, sub. *pro tem.*

Govind Gangadhar Sapre, Ranger, 6th grade, to be Ranger, 5th grade

21st June 1899.—No. 2353.—Privilege leave for three months, under article 291 of the Civil Service Regulations, was granted to Mr. W. P. Thomas, Deputy Conservator of Forests, 1st grade, Central Provinces, with effect from the 16th December 1898.

Order No. 238. dated the 19th January 1899, is hereby cancelled.

23rd June 1899.—No. 15.—Privilege leave for 15 days, under article 291 of the Civil Service Regulations, is granted to Deputy Ranger Baldeo Singh, Permanent Establishment, Jubbulpore Division, with effect from the date he completes giving over charge of the Sihora Range to Deputy Ranger Muhammad Yasin.

23rd June 1899.—No. 16.—Barkhurdar Ali, Deputy Ranger, Nimar Division, who was granted leave on medical certificate for three months with effect from the 13th January 1899 by Department Order No. 49, dated the 13th March 1899, having been permitted to return to duty within the period of his leave on 30th March 1899 in the forenoon, the unexpired portion of the leave is hereby cancelled.

28th June 1899.—No. 2480.—Mr. C. Somers-Smith, Deputy Conservator of Forests, Punjab, who has been transferred to the Central Provinces by Government of India, Revenue and Agriculture Department, Notification No. 549F., dated the 14th June 1899, is posted to the charge of the Saugor Forest Division.

28th June 1899.—No. 2481.—On being relieved by Mr. C. Somers-Smith, Mr. G. Falconer Taylor, Deputy Conservator of Forests, in charge of the Saugor Forest Division, is transferred to the charge of the Nimar Forest Division.

28th June 1899.—No. 2482.—Mr. M. Muttannah, Extra Deputy Conservator of Forests, in charge of the Nimar Forest Division, was, on relief by Mr. G. Falconer Taylor, placed on special duty in that Division from the 10th to the 24th April 1899 (both dates inclusive).

30th June 1899.—No. 2515.—On being relieved by Mr. F. S. Barker, Deputy Conservator of Forests, of the charge of the Nagpur-Wardha Division, Mr. Narayan Parshad Bajpai, Extra-Assistant Conservator of Forests, is directed to hold charge, as a temporary measure, of the Direction Division, Southern Circle, Central Provinces.

8—BURMA GAZETTE.

8th June 1899.—No. 5.—With reference to Revenue Department Notification No. 171 (Forests), dated the 15th May 1899, Mr. H. B. Anthony, Deputy Conservator of Forests, made over, and Mr. G. R. Long, Deputy Conservator of Forests, received, charge of the Thaungyin division on the afternoon of the 2nd June 1898.

13th June 1899.—No. 6.—With reference to Revenue Department Notification No. 182 (Forests), dated the 18th May 1899, Mr. E. M. Buchanan, Extra Deputy Conservator of Forests, made over, and Mr. H.

Jackson, Deputy Conservator of Forests, received charge of the Myittha division on the afternoon of the 8th June 1899.

14th June 1899.—No. 27.—With reference to Revenue Department Notification No. 184 (Forests), dated the 18th May 1899, Mr. A. H. M. Lawson, officiating Deputy Conservator of Forests, relinquished charge of his duties as special girdling officer in the Bhamo division on the forenoon of the 19th May 1899, and reported his arrival for duty in the Mandalay Forest division on the forenoon of the 22nd May 1899.

17th June 1899.—No. 12.—With reference to Revenue Department Notification No. 182, dated the 18th May 1899, Mr. E. M. Buchanan, Extra Deputy Conservator of Forests, joined the Pegu Circle on the forenoon of the 15 June, and was on the same day placed on special duty in connection with the Tharrawaddy Forest School.

20th June 1899.—No. 221.—Under the provisions of articles 277 and 291 of the Civil Service Regulations, privilege leave for three months is granted to Moung Tha Ka Do, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

21st June 1899.—No. 225.—Under the provisions of article 291 of the Civil Service Regulations, privilege leave for three months is granted to Mr. W. H. Craddock, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

21st June 1899.—No. 100.—At the Departmental examination held at Rangoon on the 5th June 1899, the following officers passed the examination in Burmese by the standards specified below :

Higher Standard.

Mr. S. F. L. Cappel, Assistant Conservator of Forests.

Mr. C. E. Allen, Extra Assistant Conservator of Forests—
with credit.

Mr. J. L. Heffernan Extra Assistant Conservator of Forests.

Mr. R. R. O'Hara, Extra Assistant Conservator of Forests—
with credit.

23rd June 1899.—No. 28.—Mr. H. McL. Carson, Forest Ranger, 3rd grade, is transferred to the Myitkyina Range, Bhamo division, on being relieved of his duties in the Myitthaung subdivision of the Katha Forest Division, by Mr. E. B. Powell, Extra Assistant Conservator of Forests.

23rd June 1899.—No. 29.—Under the provisions of article 371 of the Civil Service Regulations furlough for one year on medical certificate is granted to Maung At, Forest Ranger, 3rd grade, on the permanent establishment Pyinmana Forest Division, with effect from the 1st June 1899.

23rd June 1899.—No. 80.—Mr. W. R. French, Forest Ranger, 2nd grade, reported his return on the 5th instant, from the six months' medical leave granted him in this office Notification No. 2, dated the 12th January 1899, and is posted to the Pyinmana Forest Division for duty, with effect from the 8th instant.

24th June 1899.—No. 31.—Under article 291 of the Civil Service Regulations Mr. A. S. Rencontre, Forest Ranger, 1st grade, on the permanent establishment of the Katha Forest Division, is granted three months' privilege leave from the afternoon of the 16th instant.

24th June 1899.—No. 32.—Mr. A. S. Renecontro, Forest Ranger, 1st grade, made over, and Maung Tha Zan, Ranger, 6th grade, received charge of the Mogaung Range of the Katha Forest Division on the afternoon of the 16th instant.

24th June 1899.—No. 234.—Under the provisions of articles 282 (i) and 291 of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr. C. B. Smales, officiating Deputy Conservator of Forests, with effect from the 13th July 1899, or the subsequent date on which he may avail himself of it.

24th June 1899—No. 235.—Mr. G. K. Parker, Assistant Conservator of Forests, is posted to the charge of the Mu Forest Division during the absence of Mr. Smales or until further orders,

9.—ASSAM GAZETTE.

15th June 1899.—No. 4457G.—Privilege leave of absence for two months and twenty-nine days, under article 291 of the Civil Service Regulations, is granted to Mr. D. P. Copeland, Deputy Conservator of Forests, in charge of the Darrang Forest Division, with effect from the 10th July 1899.

15th June 1899—4458G.—Babu Tara Kisor Gupta, Extra Assistant Conservator, in charge of the Nowgong Forest Division, is placed in charge of the Darrang Forest Division, in addition to his other duties, during the absence on leave of Mr. D. P. Copeland, or until further orders.

10.—HYDERABAD RESIDENCY GAZETTE.

NIL.

11.—MYSORE GAZETTE.

15th June 1899.—No. 8944—Ft. F. 27-95—The following transfers are ordered:—

Mr. G. E. Ricketts, Assistant Conservator of Forests, on general Forest duty under the Deputy Commissioner of Kadur, to be District Forest Officer of the Kadur district.

Mr. B. Hira Sing, District Forest Officer, Kadur, to be Headquarter Assistant, Conservator's office. To join on the expiry of his leave

Mr. C. Appaiya, Headquarter Assistant, Conservator's office, to be District Forest Officer, Chitaldrug.

22nd June 1899—No. 9414—Ft. F. 64-95.—Under article 171 of the Mysore Service Regulations, Mr. M. Venkatanaranappa, Assistant Conservator of Forests, Tumkur district, was granted casual leave of absence for two days, with effect from the 12th June 1899.

29th June 1899.—No. 9607—Ft. F. 89-95—Under article 188 of the Mysore Service Regulations, Mr. K. Shamaingar, Sub-Assistant Conservator of Forests, Chitaldrug district, is granted privilege leave of absence for one month, with effect from the date on which he may be relieved of the charge of the Chitaldrug District Forest office by Mr. Appaiya,

29th June 1899.—No. 9612—Ft. 43-96.—Mr. H. Srinivasa Rao, Acting Sub-Assistant Conservator of Forests, Mysore district, having availed himself of the privilege leave granted to him in Notification No. 7987—Ft. F. 43-96, dated 2nd May 1899, from the 4th and returned to duty on the forenoon of the 19th idam, the unexpired portion of the leave is hereby cancelled, and the period of leave utilized, *viz.*, 15 days, is commuted to casual leave under article 172 of the Mysore Service Regulations

NOTE.

The following pages are to be substituted for those issued with the August No. of 1899.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

6th July, 1899.—No. 608-F.—On return from the privilege leave granted him in the Notification of this Department, No. 378-F., dated the 20th April last, Mr. A. F. Gradon resumed charge of the appointment of Instructor at the Imperial Forest School, Dehra Dun, in the forenoon of the 22nd June 1899.

From the same date the services of Mr. S. Carr, officiating Instructor, were replaced at the disposal of the Government of Burma.

14th July, 1899.—No. 635-F.—Mr. C. G. Rogers, Deputy Conservator of Forests, 4th (officiating 3rd) grade, Bengal, is placed on special duty under the Inspector-General of Forests, with effect from the 6th July 1899.

14th July, 1899.—No.—640-F.—With reference to the Notification of this Department, No 576-F., dated the 23rd ultimo, Mr. J. W. Oliver, Conservator, 2nd grade, assumed charge from Mr. H. C. Hill, Conservator, 1st grade, of the School Forest Circle and the Imperial Forest School, in the forenoon of the 6th July 1899, from which date he will officiate in the 1st grade of Conservators, until further orders.

Mr. Hill received charge of the office of Inspector-General of Forests from Mr. B. Ribbentrop in the afternoon of the 8th July 1899.

20th July, 1899.—No. 645-F.—Mr. Gleadow, Deputy Director of the Imperial Forest School, Dehra Dun, is granted privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations, with effect from the forenoon of the 12th July 1899.

From the same date and until further orders :—

(i) Mr. A. F. Gradon, Instructor, is appointed to officiate as Deputy Director of the Forest School, *vice* Mr. Gleadow.

(ii) Mr. R. McIntosh, Deputy Conservator, 4th (officiating 3rd) grade, Madras Presidency, is appointed to officiate as Instructor at the Forest School, *vice* Mr. Gradon.

2.—MADRAS GAZETTE.

29th June, 1899.—No.—308.—Appointments.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. H. J. A. Porter.	Dy. Cons. of Forests, 3rd Grade, and acting in the 2nd Grade.	Dy. Cons. of Forests, 2nd Grade.	Permanent	<i>Vice</i> Mr. W. C. Hayne retired.
2	„ C. D. Mc Arthy.	Dy. Cons. of Forests, 4th Grade and acting in the 3rd Grade.	Dy. Cons. of Forests, 3rd Grade.	Do.	<i>Vice</i> No. 1.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
3	Mr. J. L. Mac C. O'Leary.	Aast. Cons. of Forests, 1st Grade, and acting Dy. Cons. of Forests, 4th Grade.	Dy. Cons. of Forests, 4th Grade.	Do.	<i>Vice</i> No. 2.
4	" C. E. C. Fischer,	Aast. Cons. of Forests, 2nd Grade, and acting Dy. Cons. of Forests, 4th Grade.	Aast. Cons. of Forests, 1st Grade.	Do.	<i>Vice</i> No. 3. The promotion of this officer is to be without prejudice to the acting appointment held by him in the 4th Grade of Dy. Conservators.
5	" J. L. Mac C. O'Leary.	Dy. Cons. of Forests, 4th Grade.	Dy. Cons. of Forests, 3rd Grade.	Acting	During the absence of Mr. J. S. Battle on furlough and until the return of Mr. Cowley-Brown from leave, or until further orders.

1st July, 1899.—No.—311.—Posting.

No.	Name of Officer.	District.	Nature of charge.	Remarks.
1	Mr. J. S. Scott	Cuddapah	Acting District Forest Officer.	During the employment of Mr. McIntosh on other duty.

4th July, 1899.—*Leave*.—M. R. Ry. T. Narayanaswami Iyer, Ranger, 4th grade, South Coimbatore division, is granted furlough on medical certificate for six months under article 371 (a) of the Civil Service Regulations, from the date on which he was relieved of his duties, viz., 14th June 1899.

4th July, 1899.—*Leave*.—M. M. R. Ry. V. O. Doraiswami Pillai, Forest Ranger, 5th grade, South Arcot district, is granted privilege leave for two months under article 291 of the Civil Service Regulations, from date of relief.

11th July, 1899.—*Transfers*.—P. Ananda Row, Forest Ranger, Ganjam, on return from leave is transferred to the Kurnool district.

T. V. Sakoji Row, Forest Ranger, Kurnool, is transferred to he Ganjam district.

18th July, 1899.—No. 318 —The privilege leave for two months granted to Mr. F Foulkes, District Forest Officer, Nellore, in Notification No. 467, published at page 989 of Part I of the *Fort St. George Gazette*, dated 18th October 1898, is extended by eight days from the 27th December 1898 to 3rd January 1899.

17th July, 1899.—*Promotions*.—The following promotions are ordered :—

Name of Officer.	Present grade.	Grade to which promoted.	With effect from	Nature of promotion.
J. P. Nazareth	Dy. Ranger, I.	Ranger, VI	1st April 1899.	Acting, <i>vice</i> Ranger Mr. C. P. Howell on leave, or until further orders.
G. S. Laarado.	Dy. Ranger, II. and sub. <i>pro. tem.</i> Dy. Ranger, I.	Do.	14th June 1899.	Acting, <i>vice</i> Ranger T. Narainswami Iyer on furlough, or until further orders.

13th July 1899.—*Promotions*.—The following promotions are ordered with effect from 1st April 1899 :—

Name.	District to which attached.	Present grade.	Grade to which promoted.	Nature of promotion.
Mr. M. Callanan	... Cuddapah	Ranger, Third grade	Ranger, Second grade	Permanent.
M. Shams-ud-din Sahib...	Salem	Do. Fourth grade.	Do. Third grade.	Do.
M. R. Ry. C. Subramania Aiyer.	Nellore	Do. do.	Do. do.	Sub. <i>pro tem.</i>

19th July 1899.—*Appointment*.—M. R. Ry. V. Subramania Aiyar, M A, to be Ranger, Sixth Grade, on probation, in the Salem district,

No.	Name of Officer.	District.	Nature of charge.	Remarks.
	Mr J. L. MacO'Leary.	Trichinopoly cum Tanjore	Acting District Forest Officer.	To join on relief by Mr. Cowley-Brown.

26th July, 1899.—*Leave*.—M. R. Ry. A. Subba Rao, Ranger, 5th grade, North Arcot district, is granted privilege leave under article 291 of the Civil Service Regulations for one month from date of relief.

27th July, 1899.—*Leave*.—The nine months' and fifteen days' leave on medical certificate under article 369 of the Civil Service Regulations granted to Mr. C. P. Howell, Forest Ranger, 1st grade, South Coimbatore Division in S. O. Nos. 41 and 202 of 1898-99, and published in the *Fort St. George Gazette* Part II, dated 27th June 1899, page 860, is further extended by one month and a half.

8—BOMBAY GAZETTE.

5th July, 1899.—No. 4652.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. Ardeshir Nasarvánji Master, L.C.E., to be Extra Assistant Conservator of Forests, 2nd grade.

Mr. Abdul Rasul Khajbáksh to be Extra Assistant Conservator of Forests, 3rd grade.

Mr. Bajbhai Jadhavbhái Patel, L.C.E., to be Extra Assistant Conservator of Forests, 4th grade, and to be Assistant to the Divisional Forest Officer, Násik.

5th July, 1899.—No. 4653.—Mr. R. S. Fagan, Deputy Conservator of Forests, 2nd grade, has been allowed by her Majesty's Secretary of State for India to return to duty within the period of his leave.

6th July 1899.—No. 1018.—Messrs. A. G. Kdie and J. Dodgson, acting Deputy Conservators of Forests, 4th grade, respectively delivered over and received charge of the Divisional Forest office, North Thána, on the 1st July 1899, in the forenoon.

7th July, 1899.—No. 4714.—Mr. L. S. Osmaston, Deputy Conservator of Forests, 3rd grade, and Divisional Forest Officer, Working Plans, Central Circle, is granted privilege leave of absence for two months and twenty-seven days from or after the 29th instant.

8th July, 1899.—No. 2071.—Messrs. W. E. Copleston and E. G. Oliver, Deputy Conservators of Forests, respectively delivered over and received charge of the Belgaum Forest Division in the afternoon of the 29th June 1899.

20th July, 1899.—No. 1942.—Messrs. G. R. Takle and W. R. Govande, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the Sholapur Division in the forenoon of the 11th July 1899.

24th July 1899.—No. 1186.—Mr. J. A. McIver, Forest Demarcation Officer, Dánga, has been relieved of his duties as Demarcation Officer, Dánga, in the afternoon of the 18th instant.

24th July, 1899.—No. 2994.—Messrs. G. P. Millett, Deputy Conservator of Forests, and B. J. Patel, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Sub-Division Office, Násik, on the 15th July 1899, in the afternoon.

26th July, 1899.—No. 5161.—Mr. F. R. Dasai, Conservator of Forests, N. C., is allowed privilege leave of absence for three months with effect from 3rd August 1899.

27th July 1899.—No. 2491.—Messrs. D. A. Thomson, acting Deputy Conservator of Forests, and G. R. Takle, Extra Assistant, respectively delivered over and received charge of the Sub-Division Forest office, Koláha, in the forenoon of the 19th instant.

29th July 1899.—No. 5249.—His Excellency the Governor in Council is pleased to appoint Mr. O. H. L. Napier to hold charge of the office of Divisional Forest Officer, Working Plans, Central Circle, in addition to his own, during the absence of Mr. L. S. Osmaston on leave or pending further orders.

No. 5250.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. G. M. Ryan to hold charge of the office of Conservator of Forests, N. C., during the absence of Mr. Framji Rustamji Dasai on leave or pending further orders.

Mr. Krishnaji Babaji Phadke to hold charge of the office of Divisional Forest Officer, South Thana, vice Mr. G. M. Ryan, pending further orders.

4.—BENGAL GAZETTE.

4th July 1899.—No. 2143.—Six months' leave on medical certificate under article 369 of the Civil Service Regulations, is granted to Babu Guru Das Chatterjee, Extra Assistant Conservator of Forests, attached to the Singhbhum Division, with effect from the afternoon of the 2nd May 1899.

11th July 1899.—No. 2227.—Mr. E. P. Stebbing, Officiating Deputy Conservator of Forests, on transfer from the Chittagong Forest Division, took over charge of the Darjeeling Forest Division, from Mr. C. G. Rogers, Deputy Conservator of Forests, in the afternoon of the 27th June 1899, from which date the services of the latter are placed at the disposal of the Government of India for special duty.

5.—N.-W.P. AND OUDH GAZETTE.

26th July 1899.—No. ²⁸⁷⁹ II-622B.—The undermentioned officers have been granted by Her Majesty's Secretary of State for India permission to return to duty:—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. J. W. Oliver	Forest.	Conservator of Forests.	Within period of leave.

14th July 1899.—No. ²⁸⁸² II-439 C.—Babu Raghu Nath Pathak, Extra Assistant Conservator of Forests, attached to the Kheri Division of the Oudh Forest Circle, on being relieved, privilege leave for three months.

18th July 1899.—No. ²⁷¹⁵~~11-59~~ A. I. The following temporary promotions among Forest Officers are notified for general information :—

Entry No	With effect from.	Consequent on.	Name.	From	To
1	25th June 1899.	Mr. F. A. Leet's departure on privilege leave	Mr. H. G. Billson.	Asst. Conservator, 1st grade, <i>Pro v. Sub.</i>	Officiating Dy. Conservator, 4th grade.
2	27th June 1899.	Mr. L. Mercer's departure on privilege leave.	Mr. B. B. Osmaston	Officiating Deputy Conservator, 3rd grade.	Officiating Dy. Conservator, 2nd grade.
			Mr W. H. Lovegrove	Deputy Conservator, 4th grade.	Officiating Dy. Conservator, 3rd grade.
			Mr. A. C. Milward.	Officiating Assistant Conservator, 1st grade.	Officiating Dy. Conservator, 4th grade.

24th July 1899 —No. ²⁷⁷⁰~~11-5950~~. Mr. F. F. R. Channer, Assistant Conservator of Forests, attached to the Gonda Forest Division, Oudh Forest Circle, privilege leave for two months and twenty-nine days with effect from 17th August 1899.

24th July 1899 —No. ²⁷⁷¹~~11-5950~~. Mr. H. C. Billson, Assistant Conservator of Forests, attached to the Gorakhpur Forest Division, of the Oudh Circle, to hold charge of the Gonda Forest Division of the same Circle, in addition to his own duties, during the absence on leave of Mr. F. F. R. Channer, or until further orders.

6.—PUNJAB GAZETTE.

8th July 1899.—No. 301.—In consequence of the transfer, with effect from the 1st June 1899, of the head-quarters of the Chenab Forest Division from Gujranwala to Wazirabad, in column 2, opposite entry No. 4 of the tabular statement attached to Punjab Government Notification No. 124 of the 10th of March 1897, for "Gujranwala" read "Wazirabad."

8th July 1899.—No ³⁰⁴~~A. L. No. 15~~. The following change has taken place in the list of Forest Officers in the Associated Provinces, with effect from the date specified :—

Name.	Present grade.	(Grade to which promoted, or reverted.)	With effect from	REMARKS.
Mr. S. L. Kenny ...	Provisional Asst Conservator, 1st grade.	Officiating Dy. Conservator, 4th grade.	18th April	Consequent on the departure of Mr. R. M. Williamson on six months' special leave

7.—CENTRAL PROVINCES GAZETTE.

8th June 1899.—No. 11. Jan Muhammad, Deputy Ranger, 2nd grade, sub. *pro tem.*, Damoh Division at present under suspension and who has absconded in order to avoid arrest on a charge of criminal breach of trust, is dismissed from the Government service with effect from the 18th February 1899.

1st July 1899.—No. 2549.—Mr. A. Hunt, Ranger, 1st grade, is appointed to be an Extra-Assistant Conservator of Forests, 4th grade, with effect from the 22nd December 1898, *vice* Mr. Muhammad Kadir Baksh, Extra-Assistant Conservator of Forests, 2nd grade, deceased, but will continue to be on Foreign Service

3rd July 1899.—No 17.—Leave without pay for two years, granted under article 372 of the Civil Service Regulations, by Departmental Order No. 10, dated the 3rd June 1899, to Temporary Deputy Ranger Rajendra Lal Shaw, Nimar Division, with effect from the 15th June 1899, is hereby cancelled.

5th July 1899.—No 18.—The following changes have taken place in the list of Forest Rangers in the Central Provinces with effect from the date specified against each:—

Name.	Present grade	Grade to which promoted.	With effect from	Remarks.
Mr. S. R. Parsons.	Ranger, 1st grade, sub. <i>pro tem.</i>	Ranger, 1st grade.	22nd Decr. /98.	Consequent on the appointment of Mr. A. Hunt, Ranger, 1st grade, as Extra Assistant Conservator of Forests, 4th grade.
„ J. F. Anthony.	Ranger, 2nd grade, sub. <i>pro tem.</i>	Ranger, 2nd grade.	Do	
„ R. N. Thompson.	Ranger, 3rd grade, sub. <i>pro tem.</i>	Ranger, 3rd grade.	Do.	
„ W. G. Slaney.	Ranger, 4th grade, sub. <i>pro tem.</i>	Ranger, 4th grade.	Do.	
N. C. Chatterjee.	Ranger, 3rd grade, sub. <i>pro tem.</i>	Ranger, 3rd grade.	4th June 1899.	Consequent on the retirement of Muhammad Yasin, Ranger, 3rd grade, from Government service.
Mr. W. J. Anthony	Ranger, 4th grade.	Ranger, 3rd grade, sub. <i>pro tem.</i>	Do.	
Shyam Sunder.	Ranger, 5th grade.	Ranger, 4th grade.	Do.	
Govind Gangadhar Sapre.	Ranger, 6th grade.	Ranger, 5th grade.	Do.	

Departmental Order No. 14, dated the 16th June 1899, published in the *Central Provinces Gazette*, dated the 1st July 1899, is hereby cancelled.

4th July, 1899.—No. 2581.—On completion of the special temporary duty on which he is engaged in the Bastar Feudatory State, Mr. A. W. Blunt, Deputy Conservator of Forests, is placed on special duty in the Raipur Forest Division.

10th July, 1899.—No. 19.—Balkrishna D. Ukidwe, Ranger, 6th grade, Southern Circle, is promoted to Ranger, 5th grade, with effect from the 7th June 1899, to fill an existing vacancy.

10th July 1899.—No. 20.—Shiv Parshad, Deputy Ranger, 2nd grade, sub *pro tem*, attached to the Hoshangabad Division, is confirmed in that grade with effect from the 1st July 1899.

10th July 1899.—No. 21.—Privilege leave for one month, under article 291 of the Civil Service Regulations, is granted to Saiyid Naki Raza, Deputy Ranger, Permanent Establishment, Narsinghpur Division, with effect from the 21st July 1899, or such subsequent date as he may be permitted to avail himself of it.

11th July, 1899.—No. 22.—The resignation of his appointment as temporary Deputy Ranger on Rs 35 per mensem tendered by Rajendra Lal Shawe is accepted, with effect from the 12th June 1899, the date on which he absented himself from duty.

18th July, 1899.—No. 2784.—Privilege leave for three months, under article 291 of the Civil Service Regulations, is granted to Mr. A. St. V. Beechey, Officiating Deputy Conservator of Forests, with effect from the date on which he may be relieved of the charge of the Sambalpur Forest Division.

18th July, 1899.—No. 2735.—Mr. Narayan Parshad Bajpai, Extra Assistant Conservator of Forests, in temporary charge of the Direction Division, Southern Circle, Central Provinces, is directed to hold charge of the Sambalpur Forest Division during the absence on privilege leave of Mr. A. St. V. Beechey, or until further orders.

14th July, 1899.—No. 2753.—Furlough for one year and three months, under article 340 (b) of the Civil Service Regulations, is granted to Mr. A. W. Blunt, Deputy Conservator of Forests, with effect from the date of completion of his special duties in the Raipur Forest Division.

19th July, 1899.—No. 28.—Privilege leave for two months, under article 291 of the Civil Service Regulations is granted to Deputy Ranger Sheikh Haidar, Permanent Establishment, Nimai Division, with effect from the 25th July 1899, or such subsequent date as he may be permitted to avail himself of it.

8.—BURMA GAZETTE.

30th June, 1899.—No. 18.—Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, was relieved of the charge of the Prome Division by Mr. A. Rodger, Assistant Conservator of Forests, on the afternoon of the 29th June 1899.

3rd July, 1899.—No. 240.—The following alterations in rank are ordered in the Forest Department:—

- (1) With effect from the 11th February 1899, consequent on the appointment of Mr. J. Nisbet as Conservator, 3rd grade :
 - Mr. H. B. Ward, Deputy Conservator, 1st grade, substantive provisional, to be confirmed in that grade.
 - Mr. A. Weston, Deputy Conservator, 2nd (officiating 1st) grade, to be Deputy Conservator, 1st grade, substantive provisional.
 - Mr. H. B. Anthony, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade.
 - Mr. H. Calthrop, Deputy Conservator, 2nd grade, substantive provisional, to be confirmed in that grade.
 - Mr. C. E. Muriel, Deputy Conservator, 3rd (officiating 2nd) grade, to be Deputy Conservator, 2nd grade, substantive provisional.
 - Mr. G. F. R. Blackwell, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.
 - Mr. H. N. Thompson, Deputy Conservator, 3rd grade, substantive provisional, to be confirmed in that grade.
 - Mr. G. R. Long, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.
 - Mr. A. M. Burn-Murdoch, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade and to officiate in the 3rd grade.
 - Mr. F. Linnell, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to be a Deputy Conservator, 4th grade, substantive provisional.
- (2) With effect from the 18th March 1899, consequent on the departure on privilege leave of Mr C. W. A. Bruce, Deputy Conservator, 4th grade :
 - Mr. G. E. S. Cubitt, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.
- (3) With effect from the 23rd April 1899, consequent on the death of Mr. G. Q. Corbett, Deputy Conservator of Forests, 3rd grade :
 - Mr. M. Hill, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.
 - Mr. A. P. Grenfell, Deputy Conservator, 3rd grade, substantive provisional, to be confirmed in that grade.
 - Mr. W. T. T. McHarg, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.
 - Mr. H. H. Forteath, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.
 - Mr. S. Carr, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade.
 - Mr. O. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to be Deputy Conservator, 4th grade, substantive provisional.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, substantive provisional, to be confirmed in that grade and to officiate as Deputy Conservator, 4th grade.

Mr. H. W. A. Watson, Assistant Conservator, 2nd grade, and officiating Assistant Conservator, 1st grade, to be Assistant Conservator, 1st grade, substantive provisional.

4th July 1899—No. 83.—Mr. C. W. A. Bruce, Deputy Conservator of Forests, reported his return from the three months' and 15 days' privilege leave granted him in Revenue Department Notification No 71 (Forests), dated the 21st February 1899, and received charge of the Pyinmana Forest division from Mr. C. W. Doveton, officiating Deputy Conservator of Forests, on the afternoon of the 1st instant.

4th July 1899.—No. 84.—Under the provisions of article 282 (i) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. C. W. Doveton, officiating Deputy Conservator of Forests, with effect from the 13th July 1899, or the date on which he may avail himself of it.

11th July 1899.—No. 14.—Mr. A. Rodger, Assistant Conservator of Forests, was relieved of the charge of the Prome division by Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, on the forenoon of the 9th July 1899.

14th July 1899.—No. 7.—With reference to Revenue Department Notification No. 208 (Forests), dated the 31st May 1899, Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, made over charge of the Magwe subdivision to Mr. C. E. Muriel, Deputy Conservator of Forests, on the afternoon of the 8th July 1899, and availed himself of the three months' and 15 days' privilege leave granted in the above notification.

15th July 1899.—No. 34.—With reference to Revenue Department Notification No. 244 (Forests), dated the 4th July 1899, Mr. C. W. Doveton, officiating Deputy Conservator of Forests, availed himself of the three months' and 15 days' privilege leave on the 13th instant.

20th July 1899.—No. 265.—Mr. J. J. Rorie, Assistant Conservator of Forests, Personal Assistant to the Conservators of Forests, Eastern and Western Circles, is transferred from Mandalay to Toungoo.

20th July 1899.—No. 267.—Mr. A. Lawrence, Assistant Conservator of Forests, is transferred from Shwebo to Pakòkku and is placed in charge of the Gangaw subdivision, Yaw Forest division.

20th July 1899.—No. 268.—Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests, is transferred from Gangaw to the charge of the Magwe subdivision, Minbu Forest division.

20th July 1899. No. 269.—On his return from leave Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, is posted to the charge of the Kindat subdivision, of the Upper Chindwin Forest division.

20th July 1899.—No. 8.—With reference to Revenue Department Notification No. 235 (Forests), dated the 27th June 1899, Mr. G. K. Parker, Assistant Conservator of Forests, made over, and Mr. C. M. Hodgson, Deputy Conservator of Forests, received charge of the Homa-lin subdivision on the forenoon of the 9th July 1899.

21st July, 1899.—No. 15.—Maung Tha Kado, Extra Assistant Conservator of Forests, was relieved of his duties in the Pegu Division on the forenoon of the 15th July 1899, and availed himself on the

date of three months' privilege leave granted him in Revenue Department Notification No. 211 (Forests), dated the 20th June 1899

24th July, 1899.—No. 16.—Mr. M. Hill, Deputy Conservator of Forests, was relieved of the charge of the Agency Division by Mr. H. S. Ker-Edie, Deputy Conservator of Forests, on the afternoon of the 24th July 1899.

27th July, 1899.—No. 279.—On his return from Dehra Dun, Mr. S. Carr, Deputy Conservator of Forests, is appointed to the charge of No. 11 Working Plans Division, *vice* Mr. C. W. Doveton, Assistant Conservator of Forests, proceeding on leave.

27th July, 1899.—No. 280.—Mr. S. Carr is appointed to the charge of No. 1 Working Plans Division, with headquarters at Pynmana, in addition to his other duties

27th July, 1899.—No. 281.—On relief by Mr. S. Carr, Mr. F. H. Todd, Assistant Conservator of Forests, is transferred from Pynmana to Toungoo.

27th July, 1899.—No. 282.—Mr. M. Hill, Deputy Conservator of Forests, is transferred from Rangoon and posted to the charge of the Bhamo Forest Division, *vice* Mr. E. S. Carr, Deputy Conservator of Forests, transferred

27th July, 1899.—No. 283.—Mr. H. S. Ker-Edie, Deputy Conservator of Forests, is appointed to the charge of the Agency Division Pegu Circle, in addition to his other duties, *vice* Mr. M. Hill, Deputy Conservator of Forests, transferred.

9.—ASSAM GAZETTE.

4th July 1899.—No. 5248G.—With effect from the 2nd July 1899, Babu Tara Kisor Gupta, Extra Assistant Conservator, 2nd grade, to be Extra Assistant Conservator, First grade.

10.—HYDERABAD RESIDENCY GAZETTE.

Nil.

11.—MYSORE GAZETTE.

14th July 1899.—No. 348 Ft. F. 1-96.—Under Article 188 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests, Shimoga district, is granted privilege leave of absence for 15 days, with effect from the 27th June 1899.

17th July 1899.—No. 445 —Ft. F. 1-96—Under Article 177 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests, Shimoga district, was granted casual leave of absence for five days, with effect from the 4th June 1899.

20th July 1899.—No. 627.—Ft. F. 27-95.—The following promotions of Forest Officers are sanctioned :—

Mr. T. Abdul Karim, from acting Deputy Conservator, 1st class, to permanent Deputy Conservator, 1st class ;

Mr. O. Narayana Row, from acting Deputy Conservator, 2nd class, to permanent Deputy Conservator, 2nd class ;

Mr. S A Bapu Row from acting Assistant Conservator, 3rd class, to permanent Deputy Conservator, 3rd class ;

Mr. M. Venkatnaruappa, from acting Deputy Conservator, 1st class, to permanent Assistant Conservator, 1st class ;

Mr. O. Appaya, from acting Assistant Conservator, 2nd class, to permanent Assistant Conservator, 2nd class ;

These promotions taking effect from 16th January 1899.

Mr. K. Shamienger, from Sub-Assistant Conservator, to permanent Assistant Conservator, 3rd class, with effect from date of this order.

Mr. H. Srinivasa Row, from Sub-Assistant Conservator, *sub pro tem*, to permanent Sub-Assistant Conservator, with effect from 8th June 1898.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

14th August 1899.—No. 708-F.—Mr. A. M. Reuther, officiating Conservator of Forests, 3rd grade, in charge of the Pegu Circle, Lower Burma, is granted privilege leave for three-and-a-half months, under articles 291 and 282 (ii) of the Civil Service Regulations, with effect from the forenoon of the 5th August 1899.

Mr. E. S. Carr, Deputy Conservator, 1st grade, Burma, is appointed to officiate as Conservator, 3rd grade, and to be in charge of the Pegu Forest Circle, during Mr. Reuther's absence, or until further orders.

2.—MADRAS GAZETTE.

7th August 1899.—No. 361.—Mr. J. L. MacCarthy O'Leary, Acting District Forest Officer, Kurnool, is granted privilege leave for three months under article 291 of the Civil Service Regulations.

This cancels Notification No. 323, published at page 895 of Part I of the *Fort St. George Gazette* dated 25th July 1899.

8th August 1899.—The promotion of Mr. D. A. Stracey to Fifth Grade of Rangers ordered in service order No. 208 of 1898-99, shall be permanent instead of sub. *pro tem*.

10th August 1899.—*Promotions and Confirmations*.—The following promotions and confirmations are ordered with effect from 1st August 1899 :—

M. Abdul Rahiman Sahib, Acting Ranger, Sixth Grade, sub. *pro tem*., South Arcot district, to be Ranger, Sixth Grade.

M. R. Ry. O. A. Ramakristna Aiyar, Deputy Ranger, Second Grade, Salem district, to be Ranger, Sixth Grade.

M. R. Ry. O. Dhan Singh, Acting Ranger, Sixth Grade, North Arcot district, to be Ranger Sixth Grade.

M. R. Ry. P. V. Alagiriswami Naidu, Acting Ranger, Sixth Grade, Trichinopoly district, to be Ranger, Sixth Grade.

10th August 1899.—*Extension of Leave*.—The one month's privilege leave on medical certificate, under article 291 of the Civil Service Regulations, granted to Ranger M. R. Ry. P. Venkatakrishnama Naidu, South Canara district, from 7th June 1899 and published on page 860, Part II of *Fort St. George Gazette* dated 27th June 1899, is extended by six weeks.

15th August 1899.—*Departmental Test*.—At the departmental examination held on the 31st July 1899, the following subordina...

passed in the subjects specified opposite their names :—

Name.	Designation.	Subject in which passed.
T. Parthasarathy Pillai	Acting Forester, third Grade, Nellore district.	Procedure and Accounts only.
A. Sitarama Aiyar	Second Clerk, district Forest Office, Trichinopoly.	Forest Act and Rules and Procedure and Accounts
A. Veeraswami Mudaliar	Attender, office of Conservator of Forests, Central Circle, Madras.	Do. Do.

19th August 1899.—*Transfers*.—The following transfers are ordered :—

(1) M. R. Ry. T. Bapu Rao, Extra Assistant Conservator, Fourth Grade, from the Chingleput to the North Arcot district for two months, or till further orders. To join at once.

(2) M. R. Ry. S. Vasudeva Reddy, Acting Ranger, from the South Arcot to the Chingleput district for two months, or till further orders. To join at once.

20th August 1899.—*Departmental Test*—The following subordinates have passed the Departmental Test, in the parts noted against each, of section 69 of the Revised Forest Code at the examination in July 1899 —

Districts	Name and designation	In parts (a) or (b).
South Coimbatore	C. S. Venkatasubbiah, Probationary Dy. Ranger, Third Grade.	Parts (a) and (b).
Madura	K. S. Narayana Iyengar, Forester, Third Grade.	Do.
Tinnevely	A. P. Srinivasa Iyengar, Forester, Third Grade.	Part (a).
	V. Muthuswami Chettyar, Forester, Third Grade.	Do.

3—BOMBAY GAZETTE.

3rd August 1899.—No. 2137.—Messrs. L. S. Osmaston and O. H. L. Napier, Deputy Conservators of Forests, respectively delivered over and received charge of the Divisional Forest Office, Working Plans, Central Circle, on the 28th July 1899, in the afternoon.

15th August 1899.—No. 1880.—Messrs. G. M. Ryan, Deputy Conservator of Forests, and R. B. Phadke, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office, South Thána, in the afternoon of the 4th August 1899.

22nd August 1899.—No. 5852.—Mr. H. W. Keys, Deputy Conservator of Forests, Third Grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

4.—BENGAL GAZETTE.

2nd August 1899.—No. 2616—In supersession of this Department Notification No. 689T.R., dated the 26th June 1899, Mr. R. G. A. Hannah, Officiating Extra Assistant Conservator of Forests, attached to the Singhbhum Forest Division, is granted privilege leave for one month and 25 days under articles 277 and 291 of the Civil Service Regulations, with effect from the 31st May 1899.

15th August 1899.—No. 2787.—One week's privilege leave, under articles 277 and 291 of the Civil Service Regulations, is granted to Mr. R. G. A. Hannah, Officiating Extra Assistant Conservator of Forests with effect from the 26th July 1899, in continuation of that granted in Notification No. 2616For. dated the 2nd August 1899.

29th August 1899—No. 3010—Mr. H. D. D. French, Deputy Conservator of Forests, 3rd (officiating 2nd) grade, having availed himself of the two months' and twenty-eight days' privilege leave granted him in Notification No. 732T.R., dated 28th June 1899, from the 10th August 1899, the following temporary promotions are ordered with effect from that date:—

Mr. C. G. Rogers, F.C.S., Deputy Conservator of Forests, 4th grade (officiating 3rd grade), to officiate in the 2nd grade of Deputy Conservators.

Mr. W. F. Lloyd, Deputy Conservator of Forests, 4th grade, to officiate in the 3rd grade of Deputy Conservators.

Mr. H. A. Farrington, Assistant Conservator of Forests, 2nd grade (officiating 1st grade), to officiate in the 4th grade of Deputy Conservators.

29th August 1899.—No. 3012—Mr. E. E. Slane, Extra Assistant Conservator of Forests, 3rd grade, is transferred from the Angul Forest Division, and is attached to the Singhbhum Forest Division. He made over charge of the Angul Forest Division on the forenoon of the 2nd August 1899, to Babu Narayan Chandra Naik, Tahsildar, and joined the Singhbhum Forest Division, with effect from the 18th idem.

Mr. R. G. A. Hannah, Officiating Extra Assistant Conservator of Forests, 4th grade, attached to the Singhbhum Forest Division, is transferred from that Division and is appointed to hold charge of the Angul Forest Division. He made over charge of his duties in the Singhbhum Division on the 2nd August and took over charge of the Angul Forest Division from Babu Narayan Chandra Naik, Tahsildar, on the afternoon of the 17th idem.

5.—N.-W.P. AND OUDH GAZETTE.

22nd August 1899—No. $\frac{2165}{11-360}$ C.—Mr. E. L. Haslett, Extra Assistant Conservator of Forests, attached to the Kumaun Division of the Central Circle, privilege leave for two days in extension of that granted him by Notification No. $\frac{2909}{11-360}$ C, dated 24th August 1898,

6.—PUNJAB GAZETTE.

18 August 1899. No. ³⁴³A. L. No. 20.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from	REMARKS
Mr. G. S. Hart.	Officiating Deputy Conservator, 2 nd Grade.	Deputy Conservator, 3 rd Grade.	23rd May 1899.	Consequent on the return of Mr. F. S. Barker from extraordinary leave.
Mr. A. W. Blunt.	Officiating Deputy Conservator, 3 rd Grade.	Deputy Conservator, 4 th Grade.	Ditto.	
Mr. S. L. Kenny.	Officiating Deputy Conservator, 4 th Grade.	Provisional Assistant Conservator, 1 st Grade.	Ditto.	

7.—CENTRAL PROVINCES GAZETTE.

24th July 1899.—No. 24.—With the previous sanction of the Chief Commissioner, Central Provinces, Surendra Nath Chatterji, Ranger, 6th grade, Bitul Forest Division, is dismissed from the service with effect from the 24th July 1899.

1st August 1899.—No. 25.—Under the authority of Chief Commissioner's Notification No. 8555, dated the 12th June 1890, Mr. W. J. Anthony, Ranger, 8rd grade, sub *pro tem.*, Hoshangabad Forest Division, is invested with the powers described in Section 67 of Act VII of 1878, as modified by Act V of 1890, Section 13.

18th August 1899.—No. 3445.—Mr. S. R. Parsons, Ranger, 1st grade, sub. *pro tem.*, is appointed to be an Extra Assistant Conservator of Forests, 4th grade, sub *pro tem.*, with effect from the 22nd December 1898, *vice* Mr. A. Hunt, Extra Assistant Conservator, 4th grade, seconded on foreign service.

24th August 1899.—No. 6545.—Mr. A. P. Percival, Assistant Conservator of Forests, is appointed to be Personal Assistant to the Chief Commissioner.

8.—BURMA GAZETTE.

26th July 1899.—No. 9.—With reference to Revenue Department Notification No. 234 (Forests), dated the 27th June 1899, Mr. C. B. Smales, Deputy Conservator of Forests, made over charge of the Mu

division to Mr. G. K. Parker, Assistant Conservator of Forests, on the afternoon of the 20th July 1899, and on the same date availed himself of the three months' and 15 days' privilege leave granted him in the above notification.

29th July—No. 286.—Mr. R. R. O'Hara, Extra Assistant Conservator of Forests, is transferred from the Tharrawaddy to the Prone Forest division.

No. 287.—On return from leave Mr. J. L. Hefferman, Extra Assistant Conservator of Forests, is posted to the Tharrawaddy Forest division.

31st July 1899.—No. 87.—Mr. J. L. Hefferman, Extra Assistant Conservator of Forests, returned to duty on the forenoon of the 28th July 1899 from the privilege leave granted him in Revenue Department Notification No. 159 (Forests), dated the 2nd May 1899.

31st July 1899.—No. 288.—The following alterations in rank are ordered in the Forest Department:—

- (1) With effect from the 11th February 1899, consequent on the appointment of Mr. J. Nisbet as Conservator, 3rd grade—

Mr. H. B. Ward, Deputy Conservator, 1st grade, substantive provisional, to be confirmed in that grade.

Mr. A. Weston, Deputy Conservator, 2nd (officiating 1st) grade, to be Deputy Conservator, 1st grade, substantive provisional.

Mr. H. Calthrop, Deputy Conservator, 2nd grade, substantive provisional, to be confirmed in that grade.

Mr. C. E. Muriel Deputy Conservator, 3rd (officiating 2nd) grade, to be Deputy Conservator, 2nd grade, substantive provisional.

Mr. W. F. L. Tottenham, Deputy Conservator, 3rd grade, substantive provisional (*seconded*), to be confirmed in that grade and to remain on the second list.

Mr. G. R. Long, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.

Mr. A. M. Burn-Murdoch, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade.

Mr. F. Linnell, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to be Deputy Conservator, 4th grade, substantive provisional.

- (2) With effect from the 18th March 1899, consequent on the departure on privilege leave of Mr. C. W. A. Bruce, Deputy Conservator, 4th (officiating 3rd) grade:

Mr. A. M. Burn-Murdoch, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, substantive provisional, to officiate as Deputy Conservator, 4th grade.

- (3) With effect from the 29th March 1899, consequent on the departure on privilege leave of Mr. C. E. Muriel, Deputy Conservator, 2nd grade, substantive provisional.

Mr. G. F. R. Blackwell, Deputy Conservator, 3rd grade to officiate as Deputy Conservator, 2nd grade.

Mr. H. H. Forteach, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. G. K. Parker, Assistant Conservator, 1st grade, substantive provisional, to officiate as Deputy Conservator, 4th grade.

- (4) With effect from the 15th April 1899, consequent on the departure on furlough of Mr. J. Copeland, Deputy Conservator, 2nd grade :—

Mr. H. Hill, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. C. R. Dun, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. R. S. Troup, Assistant Conservator, 1st grade, substantive provisional, to officiate as Deputy Conservator, 4th grade.

- (5) With effect from the 23rd April 1899, consequent on the death of Mr. G. Q. Corbett, Deputy Conservator of Forests, 3rd grade :

Mr. C. L. Toussaint, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. H. N. Thompson, Deputy Conservator, 3rd grade, substantive provisional, to be confirmed in that grade.

Mr. W. T. T. McHarg, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.

Mr. S. Carr, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade, and to officiate as Deputy Conservator, 3rd grade.

Mr. C. B. Smales, Assistant Conservator, 1st grade, to be Deputy Conservator, 4th grade, substantive provisional.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, substantive provisional, to be confirmed in that grade.

Mr. H. W. A. Watson, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade, substantive provisional, and to officiate as Deputy Conservator, 4th grade.

- (6) With effect from the 28th April 1899, consequent on the departure on privilege leave of Mr. H. B. Ward, Deputy Conservator, 1st grade :

Mr. H. B. Anthony, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade,

Mr. H. Carter, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. H. S. Ker-Edie, Deputy Conservator, 4th grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.

- (7) With effect from the 28th April 1899, consequent on the deputation of Mr. S. Carr, Deputy Conservator, 4th (officiating 3rd) grade, to Dehra Dun ;

Mr. F. Linnell, Deputy Conservator, 4th grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, to be Deputy Conservator, 4th grade, substantive provisional.

- (8) With effect from the 1st May 1899, consequent on the departure on furlough of Mr. T. A. Hauxwell, Deputy Conservator, 1st grade :

Mr. C. E. Muriel, Deputy Conservator, 2nd grade, substantive provisional, to officiate as Deputy Conservator, 1st grade.

Mr. A. F. Gradon, Deputy Conservator, 3rd grade (officiating 2nd, on the seconded list), to officiate as Deputy Conservator, 1st grade, and to remain on the seconded list.

Mr. H. Jackson, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 1st grade.

Mr. H. N. Thompson, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. C. B. Smales, Deputy Conservator, 4th grade, provisional substantive, to officiate as Deputy Conservator, 3rd grade.

- (9) With effect from the 25th May 1899, consequent on the departure on furlough of Mr. W. F. T. McHarg, Deputy Conservator, 3rd grade, substantive provisional:

Mr. A. H. M. Lawson, Deputy Conservator, 4th grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.

- (10) With effect from the 3rd June 1899, consequent on the departure on privilege leave of Mr. H. B. Anthony, Deputy Conservator, 2nd (officiating 1st) grade :

Mr. C. F. R. Blackwell, Deputy Conservator, 3rd (officiating 2nd) grade, to officiate as Deputy Conservator, 1st grade.

Mr. A. P. Grenfell, Deputy Conservator, 3rd grade, substantive provisional, to officiate as Deputy Conservator, 2nd grade.

Mr. C. W. Doveton, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to officiate as Deputy Conservator, 3rd grade.

This department Notification No. 240 (Forests), dated the 3rd July 1899, is hereby cancelled.

3rd August 1899.—No. 291.—On relief by Mr. J. J. Rorie, Assistant Conservator of Forests, Mr. F. H. Todd is transferred from Toungoo to the charge of the Yamethin subdivision of the Pyinmana Forest Division.

3rd August 1899.—No. 292.—Mr. A. H. M. Lawson, officiating Deputy Conservator of Forests, is posted to the charge of the Mandalay Dépôt and Direction Division.

3rd August 1899.—No. 293.—Mr. P. E. Plunkett, Extra Assistant Conservator of Forests, is posted to the charge of the Thaton Forest subdivision of the West Salween division.

3rd August 1899.—No. 11.—With reference to Revenue Department Notification No. 365 (Forests), dated the 20th July 1899, Mr. J. J. Rorie, Assistant Conservator of Forests, in charge of the Direction Division, and Personal Assistant to the Conservator of Forests, Western Circle, made over charge of his duties to Mr. A. Smythies, Conservator of Forests, Western Circle, on the afternoon of the 1st August 1899.

4th August 1899.—No. 295.—On return from privilege leave Mr. C. E. Muriel, Deputy Conservator of Forests, is posted to the charge of the Minbu Forest division.

4th August 1899.—No. 296.—Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, on being relieved by Mr. C. E. Muriel, Deputy Conservator of Forests, is posted to the charge of the Myittha Forest division.

7th August 1899.—No. 35.—With reference to Revenue Department Notification No. 282 (Forests), dated the 27th July 1899, Mr. E. S. Carr, Deputy Conservator of Forests, made over, and Mr. M. Hill, Deputy Conservator of Forests, received charge of the Bhamo division on the afternoon of the 1st August 1899.

11th August 1899.—No. 18.—On return from the privilege leave granted him in Revenue Department Notification No. 134 (Forests), dated the 13th April 1899, Mr. H. B. Ward, Deputy Conservator of Forests, took over charge of the Depot and Agency Division from Mr. H. S. Ker-Edie, Deputy Conservator of Forests, on the forenoon of the 11th August 1899.

12th August 1899.—No. 309.—Mr. F. B. Dickinson, Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

14th August 1899.—No. 36.—Mr. D. A. Allan, Forest Ranger, 3rd grade, reported his arrival from the six months' deputation to the School Circle, North-Western Provinces and Oudh, on the 27th July 1899, and is attached to the Mandalay division, on special duty, with headquarters at Maymyo, from the same date.

14th August 1899.—No. 12.—With reference to Revenue Department Notification No. 295 (Forests), dated the 4th August 1899, Mr. C. E. Muriel, Deputy Conservator of Forests, on return from privilege leave, received charge of the Minbu Forest division from Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, on the forenoon of the 16th June 1899.

14th August 1899.—No. 13.—With reference to Revenue Department Notification No. 296 (Forests), dated the 4th August 1899, Mr. H. Jackson, Deputy Conservator of Forests, made over, and Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, received charge of the Myittha Forest division on the afternoon of the 28th June 1899.

17th August 1899.—No. 313.—Mr. J. Nisbet, Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of furlough for six months on medical certificate.

18th August 1899.—No. 316.—Under the provisions of sections 277 and 281 of the the Civil Service Regulations, privilege leave for

35 days is granted to Mr. A. P. Grenfell, Deputy Conservator of Forests, Yaw division, with effect from the 4th September 1899.

18th August 1899.—No. 318.—Mr C. S. Rogers, Extra Assistant Conservator of Forests, is transferred temporarily from Mogók to Maymyo, in the Mandalay Forest division.

25th August 1899.—No. 40.—Mr. C. W. Doveton, officiating Deputy Conservator of Forests, Working Plane Division, No. II, availed himself of the three months' and 15 days' privilege leave granted him in Revenue Department Notification No. 244 (Forests), dated the 4th July 1899, on the afternoon of the 13th July 1899.

No. 41.—With reference to Revenue Department Notification No. 291 (Forests), dated the 3rd August 1899, Mr. F. H. Todd, Assistant Conservator of Forests, made over charge of the Toungoo timber measuring to Mr. J. J. Rorie, Assistant Conservator of Forests, on the afternoon of the 9th instant, and assumed charge of the Yaméthin subdivision, Pyinmana division, on the forenoon of the 5th August 1899.

26th August 1899.—No. 14.—With reference to Revenue Department Notification No. 267 (Forests), dated the 20th July 1899, Mr. A. Lawrence, Assistant Conservator of Forests, relinquished charge of his duties in the Mu division on the afternoon of the 5th August 1899.

26th August No. 15.—With reference to Revenue Department Notification No. 268 (Forests), dated the 20th July 1899, Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests, made over, and Mr. A. Lawrence, Assistant Conservator of Forests, received charge of the Gangaw subdivision, Yaw Forest division, on the afternoon of the 16th August 1899.

26th August 1899.—No. 334.—The following alterations in rank are ordered in the Forest Department :—

(1) With effect from the 5th June 1899, the date on which Mr. J. J. Rorie, Assistant Conservator of Forests, passed the prescribed examinations :

Mr. J. J. Rorie, Assistant Conservator of Forests, 2nd. grade, to be Assistant Conservator of Forests 1st grade, substantive provisional, and to officiate as Deputy Conservator of Forests, 4th grade.

(2) With effect from the 16th June 1899, consequent on the return from leave of Mr. C. E. Murial, Deputy Conservator of Forests :

Mr. G. F. R. Blackwell, Deputy Conservator of Forests, 3rd (officiating 1st) grade, to officiate as Deputy Conservator of Forests, 2nd grade

Mr. A. P. Grenfell, Deputy Conservator of Forests, 3rd grade, substantive provisional, officiating 2nd grade, to revert to his substantive provisional appointment.

Mr. C. W. Doveton, Assistant Conservator of Forests, 1st grade (officiating Deputy Conservator of Forests, 3rd grade) to officiate as Deputy Conservator of Forests, 4th grade.

(3) With effect from the 23rd June 1899, consequent on the return from deputation of Mr. S. Carr, Deputy Conservator of Forests ;

Mr. A. H. M. Lawson, Deputy Conservator of Forests, 4th grade, substantive provisional, officiating Deputy Conservator of Forests, 3rd grade, to revert to his substantive provisional appointment.

- (4) With effect from the 1st July 1899, consequent on the return from leave of Mr. C. W. A. Bruce, Deputy Conservator of Forests :

Mr. C. B. Smales, Deputy Conservator of Forests, 4th grade, substantive provisional, officiating Deputy Conservator of Forests, 3rd grade, to revert to his substantive provisional appointment.

29th August 1899.—No. 336 —Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, 3rd grade, is appointed to be Extra Assistant Conservator, 2nd grade.

9.—ASSAM GAZETTE.

2nd August 1899.—No. 6098G —With effect from the 10th July 1899, in consequence of the departure on privilege leave of Mr. D. P. Copeland, Officiating Deputy Conservator of Forests, 1st grade.—

Mr. H. G. Young, Officiating Deputy Conservator of Forests, 2nd grade, to officiate as Deputy Conservator, 1st grade.

Mr. J. E. Barrett, Officiating Deputy Conservator of Forests, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. W. F. Perrée, Deputy Conservator of Forests, 4th grade, to officiate as Deputy Conservator, 3rd grade

24th August 1899 — No. 6575G.—Privilege leave of absence for eight days, under article 291 of the Civil Service Regulations, is granted to Babu Kripanath De, Extra Assistant Conservator of Forests, Sylhet, in extension of the leave granted in Notification No. 8919G., dated the 30th May 1899.

10.—HYDERABAD RESIDENCY GAZETTE.

Nil.

11.—MYSORE GAZETTE.

23rd August 1899.—No. 1677.—*Ft. F.* 92-95.—Under article 188 of the Mysore Service Regulations, Mr. Y. Sitaramaiya, Assistant Conservator of Forests, Shimoga district, is granted privilege leave of absence for one month and thirteen days, with effect from the 15th August 1899, or such other date as he may avail himself of the same.

25th August 1899 —No. 1717—*Ft. F.* 48-96.—Under article 188 of the Mysore Service Regulations, Mr. H. Srinivasa Rao, Sub-Assistant Conservator of Forests, Mysore district, is granted privilege leave of absence for one month, with effect from such date as he may avail himself of the same.

K. Muttaiya, Ranger, Chamrajnagar Range, will, in addition to his own duties, be in charge of the Gundal Range, during Mr. Srinivasa Rao's absence on leave, or until further orders.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

14th September 1899.—No 823-F —Special leave on urgent private affairs for six months, under article 348 of the Civil Service Regulations, is granted to Mr. H. C. Hill, Conservator (Officiating Inspector General) of Forests, with effect from the 21st October 1899.

2.—MADRAS GAZETTE.

28th August 1899.—M. R. Ry. A. R. Rama Row, Forest Ranger, Fourth Grade, is promoted to Third Grade with effect from 1st August 1899.

31st August 1899 —*Leave*.—to M. R. Ry. N. Arumuga Mudaliar, Forest Ranger, Third Grade. Chingleput district, for six months on private affairs under article 370 of the Civil Service Regulations from 4th August 1899.

25th August 1899.—*Confirmations* —The following confirmations are ordered with effect from 1st April 1899 :—

Name.	District	Present rank.	Grade to which promoted	Nature of promotion.
M. R. Ry. C. Subramania Aiyar.	Nellore	Ranger, 4th Grade and sub. <i>pro tem</i> Ranger, 3rd Grade,	Ranger, 3rd Grade.	Permanent.
Mr. D. J. Evers.	Salem	Ranger, 6th Grade and sub. <i>pro tem</i> Ranger, 5th Grade	Ranger, 5th Grade.	Do.

1st September 1899.—No. 386.—Mr. J. W. Cherry, Acting Conservator of Forests. Central Circle, is granted privilege leave for one month and twenty-eight days, with effect from or after the 1st September 1899, under article 291 of the Civil Service Regulations.

3rd September 1899.—The following promotions are ordered with effect from 1st April 1899 :—

Name.	Present Grade.	Grade to which promoted	Nature of promotion.
C.S. Jesudassen Pillai	Ranger, Sixth	Ranger, Fifth	Permanent.
B. D'Sa.	Do.	Do.	Do.

3rd September 1899.—Promotion.—K. Rama Row, Forest Ranger, Fourth Grade, is promoted to Ranger, Third Grade, with effect from 1st April 1899.

4th September 1899.—The acting promotion of V. R. Venkataramiah, Ranger, notified in service order No. 208 of 1898-99, is declared permanent.

5th September 1899.—Departmental Test.—The following Subordinates have passed the Departmental Examination held in July 1899 in the subjects noted against each :—

- | | |
|---|---------------------------|
| (1) B. Krishna Row, Acting Forester, Bellary | Forest Act and Rules. |
| (2) G. K. Chidhambra Iyer, Acting Deputy Ranger, Bellary. | Forest Code and Accounts. |
| (8) B. S. Rajagopala Iyengar, Forester, Anantapur. | |

9th September 1899.—The grant of one month's privilege leave, under article 291 of the Civil Service Regulations, to M. R. Ry. T. Subroyalu Naidu Ranger, Fifth Grade, Chingleput district, by the District Forest Officer, from 1st September 1899, is approved and sanctioned.

9th September 1899—M. R. Ry. A. Subba Row, Ranger, Fifth Grade, North Arcot district, is granted privilege leave under article 291 of the Civil Service Regulations, for one month and twenty days, in continuation of the one month's privilege leave already granted to him.

14th September 1899—The grant of three months' privilege leave under article 291 of the Civil Service Regulations, to M. R. Ry. C. Dhansingh, Ranger, Sixth Grade, North Arcot district, by the District Forest Officer, from 21st August 1899, is approved and sanctioned.

15th September 1899.—Privilege leave.—To M. Shams-ud-din Sahib, Ranger, Third Grade, Salem district, for one month under article 291 of the Civil Service Regulations from 1st September 1899.

23rd September 1899.—No. 408.—Mr C. G. Douglas, District Forest Officer, the Nilguis, is granted privilege leave for three months with effect from or after the 1st October 1899, under article 291 of the Civil Service Regulations.

23rd September 1899.—No. 410 —Posting.

No.	Name of officer.	District.	Nature of charge.	REMARKS.
1	Mr. H F Arbuthnot	The Nilgiris	Acting District Forest officer.	During the absence of Mr. C. G. Douglas on privilege leave, or until further orders.

23rd September 1899.—No. 422.—Mr. H. B. Bryant, District Forest Officer, Tinnevely, is granted furlough for one year, with effect from or after the 1st November 1899, under article 340 (b) of the Civil Service Regulations.

25th September 1899.—No. 420.—Mr. E. R. Murray, the District Forest Officer of Anantapur, is granted privilege leave for two months, with effect from date of relief, under article 291 of the Civil Service Regulations.

25th September 1899.—No. 427.

No.	Name of officer.	District.	Nature of charge.	REMARKS.
1	Mr. F. C. L. Cowley Brown.	Tinnevely	Acting District Forest Officer.	During the absence of Mr. H. H. Bryant on furlough, or until further orders. To join on relief by Mr. J. S. Battie.
2	M. R. Ry. V. S. Gurunatha Pillai Avargal.	Do.	Do.	Pending the assumption of charge by Mr. Cowley Brown.

27th September 1899.—No. 428

No.	Name of officer.	District.	Nature of charge.	REMARKS.
1	Mr. C. B. Dawson.	Anantapur	Acting District Forest officer.	During the absence of Mr. E. B. Murray on privilege leave, or until further orders

30th September 1899 —No. 425.—Appointments.

No.	Name of officer.	Present grade.	Grade to which promoted or reverted.	Nature of promotion or reversion.	Remarks showing cause of vacancy, &c.
1	Mr. A. W. Peet ..	Conservator of Forests, 2nd Grade.	Conservator of Forests, 1st Grade.	Acting	During the absence of Mr. E. P. Popert on furlough, or until further orders. To take effect from the date of Mr. Peet's return from furlough.
2	Mr. J. W. Cherry ...	Conservator of Forests, 3rd Grade, and acting in the 1st Grade.	Conservator of Forests, 2nd Grade.	Do.	
3	Mr. H. A. Gass ...	Deputy Conservator of Forests, 1st Grade, and acting Conservator of Forests, 3rd Grade.	Conservator of Forests, 3rd Grade.	Do.	During the absence of Mr. J. W. Cherry on privilege leave, or until further orders.

No.	Name of officer.	Present Grade	Grade to which promoted or reverted.	Nature of promotion or reversion.	Remarks showing cause of vacancy &c.
4	Mr. C. E. Brasier ..	Deputy Conservator of Forests, 2nd Grade, and acting in the 1st Grade.	Deputy Conservator of Forests, 1st Grade.	Acting	Vice No. 3.
5	Mr. P. M. Lushington	Deputy Conservator of Forests, 3rd Grade, and acting in the 2nd Grade.	Deputy Conservator of Forests, 2nd Grade.	Do.	Vice No. 4.
6	Mr. F. C. L. Cowley Brown	Deputy Conservator of Forests, 4th Grade, and acting in the 3rd Grade.	Deputy Conservator of Forests, 3rd Grade.	Do.	Vice No. 5.
7	Mr. J. S. Soot ..	Assistant Conservator of Forests, 2nd Grade, and acting Deputy Conservator of Forests, 4th Grade.	Acting Deputy Conservator of Forests, 4th Grade.	Do.	Vice No. 6.

30th September 1899 —No. 426.—Postings.

No.	Name of officer.	Circle or district.	Nature of charge	REMARKS.
1	Mr. A. W. Peet	Central circle	Conservator of Forests.	During the absence of Mr. E. P. Popert on furlough, or until further orders. To take effect from the date of Mr. Peet's return from furlough.
2	Mr. J. W. Cherry	Southern Circle	Do.	From the date of Mr. Peet's return from furlough.
3	Mr. H. A. Gass	Do.	Do.	During the absence of Mr. J. W. Cherry on privilege leave, or until further orders.
4	Do.	Do.	On special duty	From the date of his relief by Mr. J. W. Cherry.
5	Mr. R. McIntosh	South Coimbatore.	Acting District Forest officer.	During Mr. H. A. Gass' employment on other duty, or until further orders. To join on return from the Forest School.

3.—BOMBAY GAZETTE.

8th September 1899.—No. 6370.—Mr. D. A. Thomson, Divisional Forest Officer, Kolába, is allowed privilege leave of absence for three months.

11th September 1899.—No. 6419.—His Excellency the Governor in Council is pleased to appoint Mr. Govind Ramchandra Takle to act as Divisional Forest Officer, Kolába, during the absence of Mr. D. A. Thomson on leave or pending further orders.

12th September 1899.—No. 6448.—His Excellency the Governor in Council is pleased to appoint Mr. R. S. F. Fagan, on return to duty, to be on special duty in connection with Famine Grass Operations.

18th September 1899.—No. 3593.—Mr. D. A. Thomson, Deputy Conservator of Forests, delivered over and Mr. Govind Ramchandra Takle, Extra Assistant Conservator of Forests, received charge of the Koláta Division on the afternoon of the 8th September 1899.

23rd September 1899.—No. 6672.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. W. E. Copleston on return to duty to be Divisional Forest Officer, S. D., Kánara.

Mr. H. Murray to be Divisional Forest Officer, N. D. Kánara.

Mr. E. G. Oliver to be Divisional Forest Officer Belgaum.

25th September 1899.—No. ^{Famine Fodder} — Mr. R. S. Fagan, Indian Forest Service, reported himself for duty to undersigned to-day, before noon, and was placed in charge of Famine Grass Operations, G. I. P. Railway (S. Section), under authority of Government Resolutions No. 6421 and 6448, dated 12th September 1899.

26th September 1899.—No. 6785.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. G. R. Duxbury to be Divisional Forest Officer, Násik, in addition to his own duties.

Mr. G. P. Millet to be on special duty in connection with Famine Grass Operations.

4.—BENGAL GAZETTE.

4th September 1899.—No. 3112.—Consequent on the services of Mr. C. G. D. Fordyce, Deputy Conservator, second grade, and officiating in the first grade, having been placed at the disposal of the Government of India, Mr. E. P. Stebbing, Assistant Conservator of Forests, first grade, is promoted to officiate in the fourth grade of Deputy Conservators, with effect from the 17th May 1899.

This cancels so much of Notification No. 526T.—R., dated the 15th June 1899, published in the *Calcutta Gazette* of the 21st idem, as relates to the appointment of Mr. J. W. A. Grieve, Assistant Conservator, to officiate in the fourth grade of Deputy Conservators.

4th September 1899.—No. 3118.—Consequent on the departure of Mr. C. Hatt, Assistant Conservator of Forests, first grade, and Officiating Deputy Conservator, fourth grade, on privilege leave granted him in Notification No. 1T.—R., dated the 4th May 1899, the following acting arrangements were made:—

Mr. J. W. A. Grieve, Assistant Conservator of Forests, second grade, and officiating in the first grade, officiated in the fourth grade of Deputy Conservators from the 2nd to the 8th May 1899.

“ E. P. Stebbing, Assistant Conservator of Forests, first grade, officiated as Deputy Conservator, fourth grade from the 9th to the 16th May 1899.

Mr. Grieve again acted for the remaining period of the leave (i. e.,) from the 17th May to the 18th July 1899.

This cancels Notification No. 525T.—R., dated the 15th June 1899, published in the *Calcutta Gazette* of the 21st idem.

5.—N.-W. P. AND OUDH GAZETTE.

6th September 1899.—No. ⁸⁸¹⁸~~11-422B~~.—The undermentioned officers have been granted by Her Majesty's Secretary of State for India, permission to return to duty.

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. A. G. Hart-Hampden.	Forest.	Deputy Conservator of Forests.	Within the period of leave.

6.—PUNJAB GAZETTE

7th September 1899.—No. 376.—A. L. No. 21—Messrs. A. L. McIntire and G. Hart, Deputy Conservators of Forests, respectively made over and received charge of the Kulu Forest Division at Beas Timber Depôt on the afternoon of the 27th July 1899 consequent on the former's departure on two months' and twenty-nine days' privilege leave.

Mr G. S. Hart will hold charge of the Kulu Forest Division in addition to his present charge of the Kangra Forest Division.

7.—CENTRAL PROVINCES GAZETTE.

23rd August 1899.—No 25—Privilege leave for three months, under article 291 of the Civil Service Regulations, is granted to Ranger Muhammad Sahib, Permanent Establishment, Hoshangabad Division, with effect from the 1st September 1899, or such subsequent date as he may be permitted to avail himself of it.

24th August 1899.—No. 26.—Privilege leave for one month, under article 291 of the Civil Service Regulations, is granted to Ranger Gauri Shankar, Permanent Establishment, Nimar Division, with effect from the 18th August 1899.

24th August 1899.—*Erratum*.—In Departmental Order No. 18, dated the 5th July 1899, published in the *Central Provinces Gazette* of 22nd idem, the following entries should be made immediately below Mr. Parson's name and immediately above Mr. J. F. Anthony's name:—

Name.	Present grade.	Grade to which promoted.	With effect from
Faiz Bakhsh	Ranger, 2nd grade	Ranger, 1st grade, <i>sub. pro tem.</i>	Do.

5th September 1899.—No. 28.—Privilege leave for seventeen days, under article 291 of the Civil Service Regulations, is granted to Mr. J. F. Anthony, Ranger, Permanent Establishment, Jubbulpore Division, with effect from the 15th August 1899.

14th September 1899.—No. 29.—The following transfers of Subordinates are ordered with immediate effect :—

Muhammad Yasin, Deputy Ranger, 2nd grade, from the Damoh Division to the Jubbulpore Division.

No. 4059.—Privilege leave for three weeks under article 291 of the Civil Service Regulations, is granted to Mr. R. S. Hole, Assistant Conservator of Forests, 1st grade, in charge of the Jubbulpore Forest Division, with effect from the 21st instant, or the subsequent date on which he may avail himself of it.

No. 4060.—Mr. R. C. Thompson, Extra-Assistant Conservator of Forests attached to the Direction Division, Northern Circle, Central Provinces, is appointed to hold temporary charge of the Jubbulpore Forest Division during the absence on privilege leave of Mr. R. S. Hole, or until further orders.

8.—BURMA GAZETTE.

27th August 1899.—No. 6.—Maung San E, Forest Ranger, 3rd Grade, of the West Salween division, was on privilege leave for three months from the 21st April to the 13th July 1899.

4th September 1899—No. 42.—Maung Kan Gyi, Forest Ranger, 3rd grade on the permanent establishment of the Bhamo division, is promoted as Ranger, 2nd grade, with effect from the 26th August 1899.

No. 43.—Maung Po Thin, Forest Ranger, 4th grade, on the permanent establishment of the Katha division is promoted as Ranger, 3rd grade, with effect from the 26th August 1899.

5th September 1899.—No. 340.—Under the provisions of article 282 (1) of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr. J. C. Murray, Deputy Conservator of Forests, with effect from the 18th September 1899, or the subsequent date on which he may avail himself of it

12th September 1899—No. 44.—With reference to Revenue Department Notification No. 318 (Forests) dated the 18th August 1899, Mr. C. S. Rogers, Extra Assistant Conservator of Forests, made over charge of the Mogok subdivision of the Ruby Mines division to Maung Sein Gale, Forest Ranger, on the afternoon of the 25th August 1899, and reported his arrival at Maymo for duty in the Mandalay division on the afternoon of the 31st August 1899.

15th September 1899—No. 7.—Mr. S. F. L. Cappel, Assistant Conservator of Forests, made over, and Mr. A. E. Ross, officiating Deputy Conservator of Forests, received charge of the Shwegyin Forest division on the forenoon of the 28th August 1899.

15th September 1899.—No. 8.—On being relieved by Mr. A. E. Ross, officiating Deputy Conservator of Forests, Mr. S. F. L. Cappel, Assistant Conservator of Forests, reported himself for duty in the Toun-goo Forest division on the 4th instant, before noon.

15th September 1899.—No. 45.—With the previous sanction of His Honour the Lieutenant-Governor, Maung Seik Tha Shan, Writer, on

Rs. 40 per mensem, attached to the office of the Deputy Conservator of Forests, Southern Shan States Division, is appointed on probation for six months as Ranger on Rs. 100 per mensem, on the temporary establishment of that division, *vice* Maung Pan Bon, deceased.

19th September 1899.—No. 16.—Maung Tha Gywe and Maung Shwe Le, Rangers, 3rd grade, on the permanent establishment of the Yaw and Upper Chindwin divisions, respectively, have been promoted by the Local Government as Rangers, 2nd grade, with effect from the 26th August 1899.

20th September 1899.—No. 17.—With reference to Revenue Department Notification No. 316 (Forests), dated the 18th August 1899, Mr. A. P. Grenfell, Deputy Conservator of Forests, made over charge of the Yaw division to Mr. A. Lawrence, Assistant Conservator of Forests, on the afternoon of the 6th September 1899, and availed himself of the 35 days' privilege leave granted in the above notification.

22nd September 1899.—No. 9.—Mr. H. B. Anthony, Deputy Conservator of Forests, reported his return to duty on the forenoon of the 18th September from the three months' and 15 days' privilege leave granted him in Revenue Department Notification No. 171 (Forests), dated the 15th May 1899.

22nd September 1899.—No. 368.—The following alterations in rank are ordered in the Forest Department:—

- (1) With effect from the 23rd June 1899, consequent on the return from deputation of Mr. S. Carr, Deputy Conservator :

Mr. A. H. M. Law-on, Deputy Conservator, 4th grade, substantive provisional, officiating Deputy Conservator, 3rd grade, to revert to Assistant Conservator, 1st grade, and to officiate as Deputy Conservator, 4th grade.

Mr. J. J. Rorie, Assistant Conservator, 1st grade, substantive provisional, to revert to his substantive appointment as Assistant Conservator, 2nd grade, and to continue to officiate as Deputy Conservator, 4th grade.

This cancels paragraph (8) of Revenue Department Notification No. 334 (Forests), dated the 26th August 1899.

- (2) With effect from the 2nd August 1899, consequent on the appointment of Mr. E. S. Carr, Deputy Conservator, 1st grade, to officiate as Conservator during the absence of Mr. A. M. Reuther, officiating Conservator, on privilege leave:

Mr. G. F. B. Blackwell, Deputy Conservator, 3rd (officiating 2nd) grade, to officiate as Deputy Conservator, 1st grade.

Mr. A. P. Grenfell, Deputy Conservator, 3rd grade, substantive provisional, to officiate as Deputy Conservator, 2nd grade.

Mr. C. B. Smales, Deputy Conservator, 4th grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.
- (3) With effect from the 11th August 1899, consequent on the return of Mr. H. B. Ward, Deputy Conservator, 1st grade, from leave:

Mr. G. F. B. Blackwell, Deputy Conservator, 3rd (officiating 1st) grade, to officiate as Deputy Conservator, 2nd grade.

Mr. A. P. Grenfell, Deputy Conservator, 3rd grade, substantive provisional, officiating Deputy Conservator, 2nd grade, to revert to his substantive provisional appointment.

Mr. C. B. Smales, Deputy Conservator, 4th grade, substantive provisional, officiating Deputy Conservator, 3rd grade, to revert to his substantive provisional appointment

22nd September 1899.—No. 369.—Mr. S. Carr, Deputy Conservator of Forests, is transferred from Pyinmana to the charge of the Yaw Forest division,

22nd September 1899—No. 370—Mr. A. P. Grenfell, Deputy Conservator of Forests, on return from privilege leave, is appointed to be Personal Assistant to the Conservators of Forests, Eastern and Western Circles and is posted to the charge of the Direction division, Mandalay.

22nd September 1899.—No. 371.—Mr. R. S. Tronp, Assistant Conservator of Forests, is transferred from Kyaukse to Pyinmana to the charge of the Working Plans Division No. I.

22nd September 1899.—No. 372.—Mr. J. J. Rorie, Assistant Conservator of Forests, is transferred from Toungoo to the charge of the Kyaukse subdivision of the Mandalay Forest division.

22nd September 1899—No. 373—On his return from leave Mr. H. B. Anthony, Conservator of Forests, is placed on special duty in the Kado Forest division until he receives charge of the Kado and Agency divisions from Mr. J. C. Murray, proceeding on privilege leave.

27th September 1899.—No. 10.—Mr. J. Murray, Deputy Conservator of Forests, made over, and Mr. H. B. Anthony, Deputy Conservator of Forests received charge of the Kado Forest division on the afternoon of the 25th September 1899.

27th September 1899. No. 11.—Mr. J. Murray, Deputy Conservator of Forests, made over, and Mr. H. B. Anthony, Deputy Conservator of Forests, received charge of the Agency Forest Division on the afternoon of the 25th September 1899.

9.—ASSAM GAZETTE.

7th September 1899.—No. 6063G.—Mr. A. R. Dicks, Assistant Conservator of Forests, 1st grade, attached for duty to the Garo Hills Forest Division, is appointed to have charge of that division, with effect from the 1st October 1899.

27th September 1899.—No. 7380G.—With effect from the 2nd October 1899, to fill an existing vacancy, Mr. W. A. R. Doxat, Assistant Conservator of Forests, 2nd grade, and Officiating Deputy Conservator of Forests, 4th grade, to be Assistant Conservator, 1st grade, and to continue to officiate as Deputy Conservator, 4th grade.

27th September 1899—No. 7381G.—In General Department Notification No. 4457G, dated the 15th June 1899, published at page 402 of Part I of the *Assam Gazette*, dated the 17th June 1899 granting privilege leave for two months and twenty-nine days to Mr. D. P. Copeland, Deputy Conservator of Forests, for the words "10th July" read "9th July."

27th September 1899.—No 7382G.—In General Department Notification No. 6098G., dated the 2nd August 1899, published at page 526 of Part I of the *Assam Gazette* dated the 5th August 1899, giving officiating promotions to certain Forest Officers, for the words "10th July" read "9th July."

10.—HYDERABAD RESIDENCY GAZETTE.

Nil.

11.—MYSORE GAZETTE.

16th September 1899 —No. 2346—Ft. F. 106-95.—Under article 172 of the Mysore Service Regulations, Mr. S. A. Bapu Rao, Deputy Conservator of Forests, Hassan district, is granted casual leave of absence for fifteen days, with effect from the 5th September 1899.

23rd September 1899.—No. 2514—Ft. F. 89-95.—Mr. K. Shama-lengar, Assistant Conservator of Forests, Chitaldrug district, is transferred to the Mysore district for duty under the District Forest Officer, Mysore.

25th September 1899 —No. 2537—Ft. F. 19-95.—Under article 171 of the Mysore Service Regulations, Mr. B. Ramaswamy Iyer, Assistant Conservator of Forests, Kolar district, was granted casual leave of absence for two days, with effect from the 6th September 1899.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

19th October, 1899.—No. 915-F.—With reference to the Notification of this Department No. 640-F., dated the 14th July last, Mr H. C. Hill made over charge of the office of Inspector-General of Forests to Mr. B. Ribbentrop, C.I.E., in the afternoon of the 7th October 1899, on the return of the latter officer from the privilege leave granted him in Notification No. 1984 (General), dated the 16th May 1899.

From the same date Mr. Hill proceeded on subsidiary leave preparatory to availing himself of the special leave granted him in Notification No. 829-F., dated the 14th ultimo.

23rd October, 1899.—No. 925-F.—With reference to the Notification of this Department No. 635-F., dated the 14th July last, the employment of Mr. C. G. Rogers, Deputy Conservator of Forests, on special duty under the Inspector-General of Forests, ceased with effect from the afternoon of the 5th October 1899, when he proceeded to rejoin his appointment in Bengal.

24th October, 1899.—No. 931-F.—On return from furlough, Mr. F. B. Dickinson, Conservator of Forests, 3rd Grade, is posted to the charge of the Central Forest Circle in the North-Western Provinces and Oudh, with effect from the forenoon of the 20th October 1899 when he relieved Mr. C. G. D. Fordyce, Officiating Conservator, 3rd grade, of the charge of that Circle, the latter officer reverting to his substantive appointment of Deputy Conservator in Bengal from the same date Mr. Dickinson is appointed to officiate in the 2nd grade of Conservators, until further orders.

2.—MADRAS GAZETTE.

3rd October, 1899 *Transfer*.—Mr. G. S. Lasrado, Officiating Ranger, Sixth grade, is transferred from South Coimbatore to South Malabar vice Ranger Mr. W. P. Rego proceeding on leave.

3rd October 1899.—*Leave*—Mr. W. P. Rego, Forest Ranger, Second Grade, South Malabar Division, is granted furlough for one year under article 371 of the Civil Service Regulations, from or after 1st November 1899.

5th October 1899.—No. 447.—The privilege leave for one month and twenty-eight days granted to Mr. J. W. Cherry Acting Conservator of Forests, Central Circle, in notification No. 886, published at page 1059 of the *Port St. George Gazette* dated 1st September 1899, is extended by one day, under article 291 of the Civil Service Regulations.

10th October, 1899.—*Promotions*.—The following promotions are ordered in the Ranger's class with effect from 1st July 1899.

N. S. Anantachari, from Ranger, Fifth Grade, to Ranger, Fourth Grade, permanent.

K. S. Krishnamachari, from Ranger, Fifth Grade, to Ranger, Fourth Grade, permanent.

10th October 1899.—No. 458.—Posting

Name and designation of Officer.	District.	Nature of charge.	REMARKS.
Mr. J. L. MacO. O'Leary, Deputy Conservator of Forests, Fourth Grade.	Trichinopoly	Acting District Forest Officer.	Until further orders. To join on the expiry of his privilege leave.

Ootacamund October 13, 1899.

No. 468.—

Name of officer.	District.	Nature of charge.
Mr. H. B. Bryant	... Trichinopoly and Tanjore.	Acting District Forest Officer.

15th October 1899. *Erratum*.—In the notification published on page 1148 of part II of the *Fort St George Gazette* dated 12th September 1899, granting one month's privilege leave to M. R. Ry. T. Subroyalu Naidu, Ranger, Fifth Grade, Chingleput district, for "from 1st September 1899" substitute "from 5th September 1899."

17th October, 1899. *Leave*.—Mr. L. S. Janes, Forest Ranger, Sixth Grade, South Coimbatore, is granted privilege leave for one month under article 291 of the Civil Service Regulations, from 2nd October 1899.

17th October, 1899. *Leave*.—To M. R. Ry. S. P. Kulasekaram Chetty, Forest Ranger, Fifth Grade, North Arcot district, for one month under article 369 of the Civil Service Regulations, with effect from the 18th October, 1899.

24th October, 1899. *Leave*.—Privilege leave for one month, under article 291, Civil Service Regulations, is granted to M. R. Ry. C. M. Maduranayagam Pillai Avergal, Extra Assistant Conservator of Forests, South Arcot district, with effect from the 16th October 1899.

27th October, 1899. *Transfer*.—Mr. W. C. Carroll, Extra Assistant Conservator, First Grade, from the Trichinopoly district, to the North Arcot district on relief by Mr. J. L. MacO. O'Leary.

27th October 1899. *Extension of privilege leave*.—To M. Shamsud-din Sahib, Ranger, Third Grade, Salem District, for one month under article 291 of the Civil Service Regulations in continuation of the leave already granted to him.

3.—BOMBAY GAZETTE.

3rd October 1899.—No. 1956.—Mr. C. G. Dalia, Extra Assistant Conservator of Forests and Sub-division, Surat, reported himself for duty to Mr. W. F. D. Fisher, I F. S., on special duty in connection with the grass operations, B. B. & C. I. Railway Section, on the 27th September 1899, in the afternoon, under authority of Government Resolution No. 6421, dated 12th September 1899.

9th October, 1899.—No. 2026.—Messrs. J. Dodgson and A. G. Edie, acting Deputy Conservators of Forests, Fourth Grade, respectively

delivered over and received charge of the Divisional Forest Office, North Thana, on the 30th of September 1899, in the forenoon.

9th October, 1899.—No. 4196.—Mr. E. G. Oliver, Deputy Conservator of Forests, delivered over and Mr. H. Murray, Deputy Conservator of Forests, received charge of the Northern Division of Kánra on the afternoon of the 4th October, 1899.

13th October, 1899.—No. 2107.—Messrs. C. G. Dalia, Extra Assistant Conservator of Forests, and E. M. Hodgson, Assistant Conservator of Forests, respectively delivered over and received charge of the Sub-Division Forest Office, Surat, in the afternoon of the 26th September 1899.

19th October, 1899.—No. 2154.—Messrs. A. G. Edie, acting Deputy Conservator of Forests, Fourth Grade, and D. M. Bijur, Extra Assistant Conservator of Forests, Third Grade, respectively delivered over and received charge of the Divisional Forest Office, North Thana, on the 9th of October 1899, in the forenoon.

Mr. A. G. Edie, acting Deputy Conservator of Forests, has been placed on special duty in connection with the grass operations, G. I. P. Railway, North Section, from the 10th of October 1899, under the authority of Government Resolution No. 7156, dated 9th October 1899.

20th October, 1899.—No. 4511.—Messrs. Hugh Murray and W. E. Copleston, Deputy Conservators of Forests, respectively delivered over and received charge of the Southern Division of Kánra on the afternoon of the 4th October 1899.

25th October 1899.—No. 7562.—His Excellency the Governor in Council is pleased to appoint Mr. H. W. Keys, on return to duty, to be Divisional Forest Officer, Satára.

4.—BENGAL GAZETTE.

24th October 1899.—No. 3746.—Mr. E. R. Stevens, Assistant Conservator of Forests, attached to the Singhbhum Division, is temporarily transferred in the same capacity to the Darjeeling Division.

24th October 1899.—No. 3747.—Mr. O. G. Rogers, F.O.S., Deputy Conservator of Forests, having returned to duty on the afternoon of the 26th November 1898, from the two years' furlough granted to him with effect from 5th February 1897, in India Government Notification No. 150-71-2F., of the same date, the unexpired portion of the furlough, viz., from 27th November 1898 to the 4th February 1899, both days inclusive, is cancelled.

5.—N.-W. PROVINCES AND OUDH GAZETTE.

9th October 1899.—No. ²⁷⁶⁴~~11-390~~ Babu Nand Mal, Extra Assistant Conservator of Forests, on return from leave, to be attached to the Garhwal Division of the Central Circle.

11th October 1899.—No. ³⁸⁰⁵~~11-4050~~ Mr. A. G. Hobart-Hampden, Deputy Conservator of Forests, on return from furlough, to the charge of the Bahraich Forest Division of the Oudh Circle.

17th October 1899.—No. ³⁸⁸⁶~~11-411~~—The following temporary replacements among Forest officers are notified for general information :—

Entry No.	With effect from	Consequent on	Name	From.	To.
1	27th September 1899,	Mr. L. Mercer's return from privilege leave.	Mr. B. B. Osmaston.	Officiating Deputy Conservator, 2nd grade.	Officiating Deputy Conservator, 3rd grade.
			Mr. W. H. Lovegrove.	Officiating Deputy Conservator, 3rd grade.	Deputy Conservator, 4th grade, Prov. Sub.
			Mr. R. C. Millward.	Officiating Deputy Conservator, 4th grade.	Officiating Assistant Conservator, 1st grade.

6.—PUNJAB GAZETTE

2nd October 1899.—No. ⁴⁰²—The following changes have taken place in the List of Forest Officers in the Associated Provinces with effect from the date specified against each.

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from	REMARKS
Mr. S. L. Kenny ..	Provisional Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	14th July 1899.	Consequent on the deputation of Mr. W. Mayes to Kashmir.
Mr. H. E. Bartlett ..	Provisional Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	25th July 1899.	Consequent on the departure of Mr. A. W. Blunt on furlough.
Mr. G. B. Hart ..	Deputy Conservator, 3rd Grade.	Officiating Deputy Conservator, 3rd Grade.	27th Aug 1899.	Consequent on the departure of Mr. A. L. McIntire on three months' privilege leave.
Mr. A. M. Long ..	Provisional Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	Ditto	
Mr. R. S. Hole ..	Officiating Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto	
Mr. D. O. Witt ..	Officiating Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	8th September 1899.	Consequent on the departure of Mr. A. St. V. Beechey on three months' privilege leave.

7.—CENTRAL PROVINCES GAZETTE.

20th September 1899.—No. 30.—The following Rangers of the 6th grade are promoted to the 5th grade, with effect from the 1st August 1899, to fill existing vacancies:—

Gulam Nabi Khan—Northern Circle.
Sarmast Khan—Southern Circle.

3rd October 1899.—No. 31 —*Erratum*. In the second part of Departmental Order No. 18, dated the 5th July 1899, published in the *Central Provinces Gazette* of 22nd idem, for "4th June" read "5th June 1899."

4th October 1899.—No. 32 —Ranger Shrideo Bajpai, Dindori Range, Mandla Division, is transferred to the Khandwa Range, Nimar Division.

19th October 1899.—No. 83 —Leave without pay for one year, under article 372 of the Civil Service Regulations, is granted to Deputy Ranger Babu Lal, Permanent Establishment, Betul Division, in continuation of the leave without pay for one year granted to him by Notification No. 35, dated the 12th October 1898.

No. 34.—The following transfers of subordinates are ordered with immediate effect:—

Ranger Bhaya Lal, Bargi Range, Jubbulpore Division, to the Asir Range, Betul Division.

Deputy Ranger Mulchand, Asir Range, Betul Division, to the charge of the Dindori Range, Mandla Division

30th October, 1899.—No. 4873.—On being relieved of the charge of the Jubbulpore Forest Division by Mr. R. S. Hole, on return from leave, Mr. R. C. Thompson, Extra-Assistant Conservator of Forests, is re-attached to the Direction Division, Northern Circle, Central Provinces.

30th October 1899.—Ram Lal, Forester, 3rd grade, Permanent Establishment, Jubbulpore Forest Division, is dismissed from the Service with effect from the 22nd July 1899.

8.—BURMA GAZETTE.

2nd October 1899.—No. 18 —With reference to Revenue Department Notification No. 268 (Forests), dated the 20th July 1899, Mr. C. E. Muriel, Deputy Conservator of Forests, made over, and Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests, received, charge of the Magwe subdivision on the forenoon of the 18th August 1899.

12th October 1899.—No. 398.—The Lieutenant-Governor is pleased to re-arrange the respective areas of jurisdiction of the Conservators of Forests, Eastern and Western Circles. With effect from the 1st November 1899, the two Upper Burma Forest Circles will be known as the Northern and Southern Circles, respectively.

The Northern Circle will comprise the following forest divisions:—

Bhamo.

Katha.

Mn.

Upper Chindwin.

Myittha.

Lower Chindwin.

The Southern Circle will comprise the following forest divisions:—

Ruby Mines.

Mandalay.

Mandalay Depôt.

Pyinmana.

Southern Shan States.

Yaw.

Minbu.

12th October 1899.—No. 389.—The privilege leave granted to Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, in this Department Notification No. 203 (Forests), dated the 31st May 1899, is amended to leave on medical certificate for six months.

12th October 1899.—No. 46.—With reference to Revenue Department Notification No. 292 (Forests), dated the 3rd August 1899, Mr. C. R. Dun, Deputy Conservator of Forests, made over, and Mr. A. H. M. Lawson, officiating Deputy Conservator of Forests, received, charge of the Depot Division on the afternoon of the 8th September 1899.

17th October 1899.—No. 47.—With reference to Revenue Department Notifications Nos. 369 and 371 (Forests), dated the 27th September 1899 Mr. S. Carr, Deputy Conservator of Forests made over, and Mr. B. S. Troup, Assistant Conservator of Forests, received, charge of the Working Plans Division, No. 1, on the afternoon of the 14th instant.

20th October 1899.—No. 394.—Mr. H. Calthrop, Deputy Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

21st October 1899.—No. 395.—Mr. C. M. Hodgson, Deputy Conservator of Forests, is transferred from Kindat to the charge of the Rangoon Forest Division.

21st October 1899.—No. 396.—Mr. H. S. Ker-Edie, Deputy Conservator of Forests, is transferred from Rangoon to the charge of the Upper Chindwin Forest Division.

28th October 1899.—No. 2.—With reference to Revenue Department Notification No 370, dated the 27th September 1899, Mr. A. P. Grenfell, Deputy Conservator of Forests, assumed charge of his duties as Personal Assistant to the Conservator of Forests, Western Circle, on the forenoon of the 21st October 1899, and to the Conservator of Forests, Eastern Circle, on the afternoon of the 23rd idem.

25th October 1899.—No. 399.—The following alterations in rank are ordered in the Forest Department :—

- (1) With effect from the 6th September 1899, consequent on the departure on privilege leave of Mr A. P. Grenfell, Deputy Conservator :

Mr. C. B. Smales, Deputy Conservator, 4 grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.

- (2) With effect from the 18th September 1899, consequent on the return from leave of Mr. H. Anthony, Deputy Conservator.

Mr. H. Jackson, Deputy Conservator, 3rd (officiating 1st) grade, to officiate as Deputy Conservator, 2nd grade.

Mr. H. N. Thompson, Deputy Conservator, 3rd (officiating 2nd) grade, to revert to his substantive appointment.

Mr. C. B. Smales, Deputy Conservator, 4th grade, substantive provisional (officiating 3rd) grade, to revert to his substantive provisional appointment.

- (3) With effect from the 25th September 1899, consequent on the departure on privilege leave of Mr. J. C. Murray, Deputy Conservator :

Mr. H. Jackson, Deputy Conservator, 3rd (officiating 2nd) grade, to officiate as Deputy Conservator, 1st grade.

Mr. H. N. Thompson, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade,

M. C. B. Smales, Deputy Conservator, 4th grade, substantive provisional, to officiate as Deputy Conservator, 3rd grade.

25th October 1899.—No. 401.—Mr. C. F. Rogers, Extra-Assistant Conservator of Forests, is transferred from Maymyo to the charge of the Mogok subdivision, of the Ruby Mines Forest division.

26th October 1899.—No. 48.—Mr. C. W. Doveton, officiating Deputy Conservator of Forests, returned from the three months' and fifteen days' privilege leave granted him in Revenue Department Notification No. 244 (Forests), dated the 4th July 1899, and assumed charge of the Working Plans Division, No. II, on the forenoon of the 14th October 1899.

28th October 1899.—No. 49.—With reference to Revenue Department Notification No. 370 (Forests), dated the 25th September 1899, Mr. A. P. Grenfell, Deputy Conservator of Forests, assumed charge of his duties as Personal Assistant to the Conservator of Forests, Eastern Circle, and received charge of the Direction division, Eastern Circle, from Lieutenant-Colonel C. T. Bingham, Conservator of Forests, on the afternoon of the 28rd instant.

28th October 1899.—No. 19.—With reference to Revenue Department Notification No. 369 (Forests), dated the 27th September 1899, Mr. A. Lawrence, Assistant Conservator of Forests, made over, and Mr. S. Carr, Deputy-Conservator of Forests, received charge of the Yaw Forest division on the afternoon of the 26 October 1899.

9.—ASSAM GAZETTE.

19th October 1899.—No. 7986G.—The following is published :

The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of leave, as advised in List date of the 15th September 1899:

Name.	Service.	Appointment.	Period and nature of extension.
Mr. J. C. Carroll	—	Asst. Conservator of Forests, Assam.	Privilege leave commuted to leave on Medical certificate for six months, subject to confirmation by the authorities in India.

20th October 1899.—No. 8047G.—Babu Nilkanta Mukerji, Forest Ranger, 1st Grade is appointed to officiate, on probation, as an Extra Assistant Conservator of Forests 4th Grade, with effect from the 1st November 1899.

26th October 1899.—No. 8207G.—Babu Kripa Nath De, Extra Assistant Conservator of Forests, on return from leave, was attached to the Sylhet, Forest Division, from the 21st to the 23rd July 1899, both days inclusive, and reappointed to the charge of that division, with effect from the 24th July 1899.

10.—HYDERABAD RESIDENCY GAZETTE.

NIL.

11.—MYSORE GAZETTE.

27th October, 1899.—No. 3217—*Ft. F.* 64-95.—Under article 171 of the Mysore Service Regulations, Mr. M. Venkatanaranappa, Assistant Conservator of Forests, Tumkur district, was granted casual leave of absence for five days, with effect from the 19th October 1899.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

14th November 1899.—No. 957.—140-11-F.—On return from the privilege leave granted him in the Notification of this Department, No. 645 F., dated the 20th July last, Mr. F. Glowdow resumed charge, in the afternoon of the 12th October, 1899, of the appointment of Deputy Director of the Imperial Forest School, Dehra Dun. From the same date Mr. A. F. Gradon, Officiating Deputy Director, reverted to his substantive appointment of Instructor, and the services of Mr. R. McIntosh, Officiating Instructor, are replaced at the disposal of the Government of Madras.

14th November 1899.—No. 960.—231-4.—Mr. F. B. Manson, Officiating Conservator of Forests, 3rd grade, in charge of the Tenasserim Circle, Burma, is placed on special duty under the Inspector General of Forests, in connection with the Paris Exhibition of 1900, with effect from the afternoon of the 6th November, 1899.

Mr. H. B. Ward, Deputy Conservator, 1st grade, Burma, is appointed to officiate as Conservator, 3rd grade, in charge of the Tenasserim Circle, during Mr. Manson's absence or until further orders, with effect from the afternoon of the 2nd November, 1899.

24th November 1899.—No. 983.—173-6-F.—On return from the privilege leave granted him in the Notification of this Department, No. 708 F., dated the 14th August last, Mr. A. M. Reuther, Officiating Conservator, 3rd grade, resumed charge of the Pegu Forest Circle, Lower Burma, from Mr. E. S. Carr, Officiating Conservator, in the forenoon of the 16th November, 1899.

From the same date Mr. Carr reverted to his substantive appointment of Deputy Conservator, 1st grade in Burma.

2.—MADRAS GAZETTE.

3rd November 1899.—No. 477.—Mr. C. J. Woutersz, Extra Assistant Conservator of Forests, North Coimbatore, is granted furlough for one year, under article 371 (a) of the Civil Service Regulations.

3rd November 1899.—*Appointment.*—Mir Jaffer Ali Khan Sahib, Deputy Ranger, First Grade, Trichinopoly district, to be Ranger, Sixth Grade, sub. *pro tem.*, subject to the conditions that (1) he should revert to the Deputy Ranger's class when a qualified man is available to take his place and (2) that he should cease to draw pay as a Ranger if he is not actually holding a range charge or is deputed for training to the Forest School.

5th November 1899.—*Leave.*—Mr. G. S. Lasrado, Acting Ranger, Sixth Grade, on special duty in South Coimbatore, is granted privilege leave, under article 291 of the Civil Service Regulations, for nineteen days from the 11th November 1899.

5th November 1899.—*Promotions*.—The following promotions are ordered, with effect from 1st October 1899 :—

Name.	Present grade.	Grade to which promoted.	Nature of promotion.
Mr. J. P. Nasareth...	Deputy Ranger, I, and Acting Ranger, VI.	Ranger, VI ...	Permanent.
„ G. S. Lacerado...	Deputy Ranger, II, and Acting, Ranger VI.	Deputy Ranger, I...	Do.
Do.	Deputy Ranger, I.	Ranger, VI ...	Acting.

5th November 1899.—*Transfers*—The following transfers are ordered :—

Name and designation.	From	To
K. Gajaraja Mudaliar, Forest Ranger, Fifth Grade.	North Coimbatore	Tinnevely.
K. Saiyud Edullah Sahib, Forest Ranger, Fifth Grade.	Tinnevely	North Coimbatore.

6th November 1899.—No. 480.—Posting

No.	Name of officer.	District.	Nature of charge.	Remarks.
1	Mr. G. Hadfield	South Malabar.	District Forest Officer.	To join on return from furlough.
2	Mr. A. B. Jackson.	Tinnevely ...	Do.	To join on relief by Mr. Hadfield. This cancels Mr. Cowley-Brown's appointment as acting District Forest Officer, Tinnevely, published in notification No. 427 on page 1229 of Part I of the Fort St. George Gazette dated 3rd October 1899.

16th November 1899.—*Appointment*.—M.R.Ry. T S. Venugopala Iyer to be Manager, Conservator of Forests' office, Northern Circle, from 1st November 1899 *vice* Mr. Setn Row retired.

17th November 1899.—No. 504.—Appointments.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
	Mr. C. J. Woutersz ...	Extra Assistant Conservator of Forests, Third Grade.	Extra Assistant Conservator of Forests, Second Grade.	Permanent.	With effect from 12th May 1899— <i>vide</i> G. O., No. 692, Revenue, dated 21st September 1899.
	M. R. Ry. M. Rama Rao Garu	Do, Fourth Grade.	Do, Third Grade.	Do.	<i>Vice</i> No. 1.

18th November 1899.—*Privilege leave*.—To Mir Jaffer Ali Kirmani Sahib, Ranger, Sixth Grade, sub. *pro. tem*, Trichinopoly district, under article 291 of the Civil Service Regulations, for ten days from 10th November 1899

21st November 1899.—*Erratum*.—In service order 84 of 1899, granting privilege leave to Mr. G. S. Lasrado, Acting Ranger, Sixth Grade, on special duty in South Coimbatore, for “nineteen days from 11th November 1899” read “fourteen days from 16th November 1899.”

29th November 1898.—*Leave*.—Privilege leave for one month under article 291, Civil Service Regulations, is granted to Mr. W. Carroll, Extra Assistant Conservator of Forests, North Arcot district, from the 15th December 1899.

3.—BOMBAY GAZETTE.

3rd November 1899.—No. 2383.—Mr. G. M. Ryan, Deputy Conservator of Forests, Third Grade, was relieved by the undersigned of charge of the office of the Conservator of Forests, Northern Circle, on the 3rd November 1899, in the forenoon.

7th November 1899.—No. 3090.—Messrs. L. Napier and L. S. Osmaston, Deputy Conservators of Forests, respectively delivered over and received charge of the Divisional Forest Office Working Plans, Central Circle, on the 28th October 1899, in the afternoon.

7th November 1899.—No. 3108.—Messrs. A. N. Master, Extra Assistant Conservator of Forests, and H. W. Keys, Deputy Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office Sâtara, in the forenoon of the 27th October 1899.

11th November 1899.—No. 3183.—Messrs. A. N. Master, Extra Assistant Conservator of Forests, and H. W. Keys, Deputy Conservator of Forests, respectively delivered over and received charge of the Sub-divisional Forest Office, Sâtara, on the 6th November 1899, in the afternoon.

13th November 1899.—No. 2516.—Messrs. K. B. Phadke, Extra Assistant Conservator of Forests, Third Grade, and G. M. Ryan, Deputy Conservator of Forests, Third Grade, respectively delivered over and received charge of the Divisional Forest Office South Thana, on the 4th of November 1899, in the afternoon.

21st November 1899.—No. 8325.—The undermentioned officers passed on the 7th October 1899 the examination in Law prescribed in No. 4 of the rules published in Government Notification No. 2, dated 3rd January 1894, for the examination of officers of the Forest Department :—

Passed with Credit.

Mr. H. N. Nadkarni, Extra Assistant Conservator of Forests, S. D., Kánara.

Mr. G. R. Takle, Sub-Divisional Forest Officer, Kolába

Passed.

Mr. R. S. Pearson, Divisional Forest Officer, West Khandesh.

Mr. G. I. Rega, Extra Assistant Conservator of Forests and Personal Assistant to the Conservator of Forests, S. O.

2. The names are arranged in the order of merit.

27th November 1899.—No. 5402.—Mr. H. A. Nadkarni, Sub-Divisional Forest Officer, S. D. Kánara, who was ordered to be in charge of the Demarcation Party now working in the Western Division of Kánara, made over charge of his duties in the former Division on the afternoon of 6th November 1899, and reported himself for duty to the Divisional Forest Officer, W. D. Kánara, on the afternoon of 13th idem.

30th November 1899.—No. 3410.—Messrs. H. W. Keys, Deputy Conservator of Forests, and A. N. Master, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Sub-division Forest Office, Satara, on the forenoon of the 20th November 1899.

4—BENGAL GAZETTE.

25th November 1899.—No. 4166.—Consequent on the departure of Mr. J. W. A. Grieve, Officiating Deputy Conservator of Forests, on privilege leave granted him in Notification No. 688T.R., dated 26th June 1899, on 17th July 1899, when he made over charge of the Buxa Division to Mr. T. H. Monteath, the following promotion is ordered from that date:—

Mr. H. A. Farrington, Assistant Conservator of Forests, second grade, to officiate in the fourth grade of Deputy Conservators.

25th November 1899.—No. 4167.—Consequent on the return of Mr. C. C. Hatt, Officiating Deputy Conservator of Forests from privilege leave on the afternoon of the 18th July 1899, the following orders are passed:—

Mr. H. A. Farrington, Officiating Deputy Conservator of Forests, fourth grade, to revert to his officiating appointment of Assistant Conservator of Forests, first grade.

25th November 1899.—No. 4168.—Mr. T. H. Monteath, Assistant Conservator of Forests, on being relieved of the charge of the Buxa Forest Division by Mr. Grieve on the 21st October 1899, is attached to the Darjeeling Forest Division.

28th November 1899.—No. 4180.—Mr E. R. Stevens, Assistant Conservator of Forests, temporarily attached to the Darjeeling Division, is transferred in the same capacity to the Singhbhum Division.

28th November 1899.—No. 4181.—On the return to duty, on the forenoon of the 7th November 1899, of Mr. H. D. D. French, Officiating Deputy Conservator of Forests, 2nd grade, from the 2 months and 28 days' privilege leave granted him in Notification No. 732T.R., dated 28th June 1899, Mr. French took over charge of the Sonthal Parganas Division from Mr. Coutts, Subdivisional Officer, Dumka.

The following reversions are ordered with effect from the above date:—

Mr. H. H. Haines, F. C. S., Officiating Deputy Conservator of Forests, 3rd grade, to the 4th grade of Deputy Conservators.

Mr. E. P. Stebbing, Officiating Deputy Conservator of Forests, 4th grade, to the 1st grade of Assistant Conservators.

5.—N.-W. PROVINCES AND OUDH GAZETTE.

7th November 1899.—No. $\frac{4160}{11-622B}$. The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of leave.—

Name.	Service.	Appointment.	Period and nature of leave
Mr. S. Eardley-Wilmot.	Forest.	Conservator of Forests	Fifteen days' furlough.

7th November 1899.—No. $\frac{1451}{11-622B}$. The undermentioned Officer has been granted by Her Majesty's Secretary of State for India permission to return to Duty.

Name.	Service.	Appointment.	Date on which permitted to return
Mr. S. Eardley-Wilmot.	Forest.	Conservator of Forests.	Within the period of leave.

17th November 1899.—No. $\frac{4370}{11-86A-8}$. With effect from the 25th October 1899, the date on which Mr. J. C. Tulloch, returned from privilege leave.

Mr. H. G. Billson, officiating Deputy Conservator of Forests 4th grade, to revert as Assistant Conservator of Forests, 1st grade, *provisio sub.*

30th November 1899.—No. $\frac{4009}{11-861-1}$. Mr. R. H. B. M Pobree, who has been appointed to the Forest Department by the Secretary of State for India and who reported his arrival in Bombay on the 24th November 1899, to be an Assistant Conservator of Forests, 2nd grade, and to be attached to the Ganges Division of the Central Forest Circle.

6.—PUNJAB GAZETTE.

10th November 1899.—No. $\frac{452}{A. L. No. 22}$.—*Leave.*—Messrs. A. V. Monro and H. A. Hoghton, Deputy Conservators of Forests, respectively made over and received charge of the Hazára Division on the forenoon of the 21st October 1899, consequent on the former's departure on one year's furlough.

Mr. Hoghton will continue to hold charge of the Rawalpindi Division in addition to that of the Hazára Division.

10th November 1899.—No ⁴⁵⁶ A. L. No. 23.—The following change have taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. A. V. Mouro ...	Officiating Deputy Conservator, 3rd Grade.	Deputy Conservator, 4th Grade.	21st October 1899.	Consequent on the departure of Mr. A. V. Monro on one year's furlough.
Mr. C. O. Hanson ..	Officiating Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	Ditto.	
Mr. R. M. Williamson ...	Provisional Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	24th October 1899.	Consequent on the return of Mr. R. M. Williamson from special leave.
Mr. C. O. Hanson ...	Officiating Deputy Conservator, 3rd Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto.	
Mr. G. S. Hart ...	Officiating Deputy Conservator, 2nd Grade.	Deputy Conservator, 4th Grade.	26th October 1899.	Consequent on the return of Mr. A. L. McIntire from privilege leave.
Mr. R. M. Williamson ...	Officiating Deputy Conservator, 3rd Grade.	Provisional Deputy Conservator, 4th Grade.	Ditto.	
Mr. D. O. Witt ..	Officiating Deputy Conservator, 4th Grade.	Officiating Assistant Conservator, 1st Grade.	Ditto.	

13th November 1899. No. ⁴⁶⁰ A. L. No. 24.—Mr. B. O. Coventry, Deputy Conservator of Forests, and Mr. A. J. Gibson, Assistant Conservator of Forests, respectively made over and received charge of the Direction Division and the duties of the Personal Assistant to Conservator of Forests, Punjab on the afternoon of the 31st October 1899.

Mr. A. J. Gibson, Assistant Conservator of Forests, was relieved of his duties in the Kangra Forest Division on the forenoon of the 28th October 1899.

14th November 1899.—No 466.—His Honor the Lieutenant-Governor is pleased to approve of the following appointment and reversion in the list of Extra Assistant Conservator of Forests in the Punjab, with the effect from 1st October 1899 :—

Munshi Ghulam Muhammad, Probationary Extra Assistant Conservator, 4th Grade, to revert to the rank of Ranger, 1st Grade

Pandit Thakur Das, Extra Assistant Conservator of Forests, 4th Grade, provisional substantive on probation, is to be on probation in a permanent vacancy.

Lála Sundar Dás, Ranger, 1st Grade, to be Extra Assistant Conservator, 4th Grade, substantive provisional on probation in the vacancy caused by the reversion of Munshi Gulám Muhammed.

14th November 1899.—No. 469.—Mr. Fazl-ud-din, Extra Assistant Conservator of Forests, and Pandit Gokal Dás, Probationary Extra Assistant Conservator of Forests, respectively made over and received charge of the Montgomery Forest Division on the afternoon of the 3rd November 1899, consequent on the former's transfer to the Lahore Forest Division. Pandit Gokal Dás was relieved of his duties in the Rawalpindi Forest Division on the afternoon of 1st November 1899.

14th November 1899.—No. ⁴⁷⁰A. L. No. 25.—Mr B. O. Coventry Deputy Conservator of Forests, and Mr. Fazl-ud-din, Extra Assistant Conservator of Forests, respectively made over and received charge of the Lahore Forest Division on the afternoon of the 4th November 1899, consequent on the former's transfer to the Rawalpindi Forest Division.

18th November 1899.—No. ⁴⁷⁸A. L. No. 26.—Messrs. G. S. Hart and A. L. McIntire, Deputy Conservators of Forests, respectively made over and received charge of the Kulu Forest Division at Pathankot on the afternoon of the 25th October 1899, consequent on the latter's return from privilege leave,—vide Punjab Government Notification No. ³⁷⁶A. L. No. 21, dated 7th September 1899.

20th November 1899.—No. ⁴⁸³A. L. No. 27.—Messrs. H. A. Hoghton and B. O. Coventry, Deputy Conservators of Forests, respectively made over and received charge of the Rawalpindi Forest Division on the afternoon of the 6th November 1899.

27th November 1899.—No. ⁴⁹³A. L. No. 28.—The following change has taken place in the list of Forest Officers in the Associated Provinces with effect from the date specified :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. R. S. Hole	Officiating Deputy Conservator, 4th Grade.	Officiating Assistant Conservator, 1st Grade.	9th November 1899.	Consequent on the return of Mr. A. St. V. Beechey from privilege leave.

7.—CENTRAL PROVINCE'S GAZETTE.

* 26th October 1899.—No. 85.—Ranger Ohintaman Vishwanath Sarwate, Narsinghpur Division, is transferred temporarily to the Betul Division.

Departmental Order No. 34, dated the 19th October 1899, so far as it concerns the transfer of Ranger Bhayalal from Jubbulpore to Betul is postponed until further orders.

26th October 1899.—No. 86.—The privilege leave for one month, with effect from the 18th August 1899, granted under Article 291 of the Civil Service Regulations to Ranger Jauri Shankar, Nimar Division, is commuted into leave on medical certificate and is extended by one month.

29th October 1899.—No. 87.—Privilege leave for 10 days, under Article 291 of the Civil Service Regulations, is granted to Ranger Mr. R. H. Cole, Permanent Establishment, Mandla Division, with effect from the 27th November 1899.

8th November 1899.—No. 5033.—On being relieved of the charge of the Sambalpur Forest Division by Mr. A. St. V. Beechey, Officiating Deputy Conservator of Forests, on return from privilege leave, Mr. Narayan Parshad Bajpai is transferred to the Raipur Forest Division.

8.—BURMA GAZETTE.

2nd November 1899.—No. 404.—Mr. S. F. L. Cappel, Assistant Conservator of Forests, is transferred from Toungoo to duty in the Tenasserim Circle, to demarcate the boundaries of the Ye, Kaleinaung and Ngawun reserves adjoining Siam.

2nd November 1899.—No. 414.—Mr. R. O. A. Pinder, Ranger, 2nd grade, is promoted to the 4th grade of Extra Assistant Conservators, and posted to duty in the Mandalay Forest division.

8th November 1899.—No. 50.—Mr. C. B. Smales, Deputy Conservator of Forests, reported his return from the privilege leave for three months and 15 days granted to him in Revenue Department Notification No. 234 (Forests), dated the 27th June 1899, and resumed charge of the Mu division from Mr. G. K. Parker, Assistant Conservator of Forests, on the 4th November 1899, in the afternoon.

9th November 1899.—No. 20.—With reference to Revenue Department Notification No. 372, dated the 27th September 1899, Mr. R. S. Troup, officiating Deputy Conservator of Forests, made over, and Mr. J. J. Rorie, officiating Deputy Conservator of Forests, received, charge of the Kyaukse subdivision, of the Mandalay Forest division, on the afternoon of the 4th instant.

13th November 1899.—No. 21.—Mr. W. H. Craddock, Extra Assistant Conservator of Forests, returned from the three months' privilege leave granted him in Revenue Department Notification No. 225 (Forests), dated 22nd June 1899, and reported his arrival at Nanpudet on the afternoon of the 8th October 1899.

14th November 1899.—No. 422.—Under the provisions of Article 291 of the Civil Service Regulations privilege leave for 21 days is granted to Mr. H. Carter, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

Mr. Carter is permitted to overstay his leave by 15 days under Article 282 (ii) of the Civil Service Regulations.

14th November 1899.—No. 423.—Mr. E. M. Buchanan, Extra Deputy Conservator of Forests, is appointed to the charge of the

Tharrawaddy Forest division, in addition to his other duties, during the absence on privilege leave of Mr. H. Carter, Deputy Conservator of Forests, or until further orders.

14th November 1899.—No. 22.—Mr. A. S. Rencontre, Forest Ranger, 1st grade, on his return from the three months' privilege leave, is posted to the Mandalay division, with effect from the forenoon of the 16th September 1899.

18th November 1899—No. 426—Under the provisions of Article 291 of the Civil Service Regulations privilege leave for three months is granted to Mr. W. J. Dalton Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it

18th November 1899—No. 427—Under the provisions of Article 291 of the Civil Service Regulations privilege leave for one month is granted to Mr. C. L. Toussaint, Deputy Conservator of Forests with effect from the 4th November 1899, after noon.

Mr. Toussaint is permitted to overstay his leave by 15 days under Article 282 (ii) of the Civil Service Regulations.

18th November 1899.—No. 428.—Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, is appointed to the charge of the Thayetmyo Forest division, in addition to his other duties during the absence of Mr. Toussaint, or until further orders

18th November 1899.—No. 429.—Under the provisions of Article 340 (b) of the Civil Service Regulations furlough for one year is granted to Mr. E. S. Carr, Deputy Conservator of Forests, with effect from the date on which he may be relieved of the Pegu Circle by Mr. A. M. Reuther, officiating Conservator of Forests

18th November 1899.—No. 51—With reference to Revenue Department Notification No. 395 (Forests), dated the 21st October 1899, Mr. O. M. Hodgson, Deputy Conservator of Forests, made over, and Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, received, charge of the Upper Chindwin division on the afternoon of the 11th November 1899.

21st November 1899.—No. 431.—The Lieutenant-Governor appoints Mr. A. Rodger, Assistant Conservator of Forests, to succeed the Forest Officer in charge of the Prome Forest Division as the Forest Officer who shall assist the Forest Settlement Officer in the enquiry ordered in this department Notification No. 42 (Forests), dated the 17th September 1896, regarding the Kywezayan fuel reserve in the Prome district.

24th November 1899.—No. 21.—With reference to Revenue Department Notifications Nos. 395 and 396 (Forests), dated the 21st October 1899 Mr. C. M. Hodgson Deputy Conservator of Forests, relieved Mr. H. S. Ker-Edie, Deputy Conservator of Forests, of the charge of the Rangoon Division, on the afternoon of the 22nd November 1899.

25th November 1899.—No. 22.—With reference to Revenue Department Notifications Nos. 427 and 428 (Forests), dated the 18th November 1899, Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, relieved Mr. C. L. Toussaint, Deputy Conservator of Forests, of the charge of the Thayetmyo division, on the afternoon of the 4th November 1899.

27th November 1899.—No. 432.—The Lieutenant-Governor is pleased to order the following promotions in the provincial Forests Service with effect from the date of this notification :—

Mr. E. M. Buchanan, Extra Deputy Conservator, 4th grade to be Extra Deputy Conservator, 3rd grade.

Messrs. P. W. Healy, R. M. Kavanagh and F. Ryan Extra Assistant Conservators 2nd grade, to be Extra Assistant Conservators, of 1st grade.

Messrs. C. S. Rogers and E. B. Powell, Extra Assistant Conservators, 3rd grade to be Extra Assistant Conservators 2nd grade.

Mr. J. W. Ryan and Maung Yaing, Extra Assistant Conservators, 4th Grade, to be Extra Assistant Conservators, 3rd grade.

27th November 1899.—No. 433.—Mr. H. Calthrop, Deputy Conservator of Forests, on return from leave is posted to the charge of the Agency Division of the Pegu Circle *vice* Mr. H. B. Ward, appointed to officiate as Conservator of Forests, Tenasserim Circle.

27th November 1899.—No. 53.—With reference to Revenue Department Notification No. 414 (Forests), dated the 8th November 1899 Mr. R. C. A. Pinder, Extra Assistant Conservator of Forests, made over, and Mr. A. S. Recontre, Forest Ranger, received charge of the Revenue subdivision, Mandalay, on the afternoon of the 22nd instant.

30th December 1899.—No. 436.—Under the provisions of Article 369 of the Civil Service Regulations leave on medical certificate for six months is granted to Maung Tha Kado, Extra Assistant Conservator of Forests, which effect from the date on which he may avail himself of it.

9.—ASSAM GAZETTE.

6th November 1899.—No. 8531G.—With effect from the 8th October 1899, in consequence of the return from privilege leave of Mr. D. P. Copeland, Officiating Deputy Conservator of Forests, 1st Grade,—

Mr. K. G. Young, Officiating Deputy Conservator of Forests, 1st Grade, to officiate as Deputy Conservator, 2nd Grade

Mr. J. E. Barrett, Officiating Deputy Conservator of Forests, 2nd Grade, to officiate as Deputy Conservator 3rd Grade

Mr. W. F. Perrée, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator, 4th Grade.

15th November 1899.—No. 8755G.—In General Department Notification No. 8431G., dated the 6th November 1899, published at page 784, Part I of the *Assam Gazette* of the 11th November 1899, for the last two lines substitute the following:

Mr. W. F. Perrée, Officiating Deputy Conservator of Forests, 3rd Grade, to revert to his substantive appointment of Deputy Conservator, 4th Grade,

10.—HYDERABAD RESIDENCY GAZETTE.

10th November 1899.—No. 374.—Mr. B. Bhukan, Extra Assistant Conservator of Forests, is transferred from the Buldana to the Amraoti Forest Division.

10th November 1899.—No. 375.—Rai Bahadur Mansukh Rai is transferred from the Amraoti Forest Division to the Buldana Forest Division, and is placed under the orders of the Conservator of Forests, Hyderabad Assigned Districts, in connection with the allotment of free-grazing lands

11.—MYSORE GAZETTE.

18th November 1899.—No. 3777 —*Ft. F.* 89-95.—Under Article 127 of the Mysore Service Regulations, Mr. K. Shamsiengar, Assistant Conservator of Forests, Mysore district, is granted casual leave of absence for one week, with effect from the 10th November 1899.

NOTE.

The following pages are to be substituted for those issued with the August No. of 1899.

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

6th July, 1899.—No. 608-F.—On return from the privilege leave granted him in the Notification of this Department, No. 878-F., dated the 20th April last, Mr. A. F. Gradon resumed charge of the appointment of Instructor at the Imperial Forest School, Dehra Dun, in the forenoon of the 22nd June 1899.

From the same date the services of Mr. S. Carr, officiating Instructor, were replaced at the disposal of the Government of Burma

14th July, 1899.—No. 635-F.—Mr. C. G. Rogers, Deputy Conservator of Forests, 4th (officiating 3rd) grade, Bengal, is placed on special duty under the Inspector-General of Forests, with effect from the 6th July 1899.

14th July, 1899.—No.—640-F.—With reference to the Notification of this Department, No 576-F., dated the 23rd ultimo, Mr. J. W. Oliver, Conservator, 2nd grade, assumed charge from Mr. H. C. Hill, Conservator, 1st grade, of the School Forest Circle and the Imperial Forest School, in the forenoon of the 6th July 1899, from which date he will officiate in the 1st grade of Conservators, until further orders.

Mr. Hill received charge of the office of Inspector-General of Forests from Mr. B. Ribbentrop in the afternoon of the 8th July 1899.

20th July, 1899.—No. 645-F.—Mr. Gleadow, Deputy Director of the Imperial Forest School, Dehra Dun, is granted privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations, with effect from the forenoon of the 12th July 1899.

From the same date and until further orders :—

(i) Mr. A. F. Gradon, Instructor, is appointed to officiate as Deputy Director of the Forest School, *vice* Mr. Gleadow.

(ii) Mr. R. McIntosh, Deputy Conservator, 4th (officiating 3rd) grade, Madras Presidency, is appointed to officiate as Instructor at the Forest School, *vice* Mr. Gradon.

2.—MADRAS GAZETTE.

29th June, 1899.—No.—308.—Appointments.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. H. J. A. Porter.	Dy. Cons. of Forests, 3rd Grade, and acting in the 2nd Grade.	Dy. Cons. of Forests, 2nd Grade.	Permanent	<i>Vice</i> Mr. W. C. Hayne retired.
2	„ C. D. Mc Arthy.	Dy. Cons. of Forests, 4th Grade and acting in the 3rd Grade.	Dy. Cons. of Forests, 3rd Grade.	Do.	<i>Vice</i> No. 1.

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
3	Mr. J. L. Mac C. O'Leary.	Aast. Cons. of Forests, 1st Grade, and acting Dy. Cons. of Forests, 4th Grade.	Dy. Cons. of Forests, 4th Grade.	Do.	<i>Vice</i> No. 2.
4	" C. E. C. Fischer,	Aast. Cons. of Forests, 2nd Grade, and acting Dy. Cons. of Forests, 4th Grade.	Aast. Cons. of Forests, 1st Grade.	Do.	<i>Vice</i> No. 3. The promotion of this officer is to be without prejudice to the acting appointment held by him in the 4th Grade of Dy. Conservators.
5	" J. L. Mac C. O'Leary.	Dy. Cons. of Forests, 4th Grade.	Dy. Cons. of Forests, 3rd Grade.	Acting	During the absence of Mr. J. S. Battie on furlough and until the return of Mr. Cowley-Brown from leave, or until further orders.

1st July, 1899.—No.—311.—Posting.

No.	Name of Officer.	District.	Nature of charge.	Remarks.
1	Mr. J. S. Scott	Cuddapah	Acting District Forest Officer.	During the employment of Mr McIntosh on other duty.

4th July, 1899.—*Leave*.—M. R. Ry. T. Narayanaswami Iyer, Ranger, 4th grade, South Coimbatore division, is granted furlough on medical certificate for six months under article 371 (a) of the Civil Service Regulations, from the date on which he was relieved of his duties, viz., 14th June 1899.

4th July, 1899.—*Leave*.—M. M. R. Ry. V. O. Doraiswami Pillai, Forest Ranger, 5th grade, South Arcot district, is granted privilege leave for two months under article 291 of the Civil Service Regulations, from date of relief.

11th July, 1899.—*Transfers*.—P. Ananda Row, Forest Ranger, Ganjam, on return from leave is transferred to the Kurnool district.

T. V. Sakoji Row, Forest Ranger, Kurnool, is transferred to he Ganjam district.

18th July, 1899.—No. 318.—The privilege leave for two months granted to Mr. F. Fonlkes, District Forest Officer, Nellore, in Notification No. 467, published at page 989 of Part I of the *Fort St. George Gazette*, dated 18th October 1898, is extended by eight days from the 27th December 1898 to 3rd January 1899.

17th July, 1899.—*Promotions*.—The following promotions are ordered :—

Name of Officer.	Present grade.	Grade to which promoted.	With effect from	Nature of promotion.
J. P. Nazareth	Dy. Ranger, I.	Ranger, VI	1st April 1899.	Acting, <i>vice</i> Ranger Mr. C. P. Howell on leave, or until further orders.
G. S. Lasrado.	Dy. Ranger, II. and sub. <i>pro. tem.</i> Dy. Ranger, I.	Do.	14th June 1899.	Acting, <i>vice</i> Ranger T. Narainswami Iyer on furlough, or until further orders.

13th July 1899 —*Promotions*—The following promotions are ordered with effect from 1st April 1899 :—

Name.	District to which attached.	Present grade.	Grade to which promoted.	Nature of promotion.
Mr. M. Callanan	Cuddapah	Ranger, Third grade	Ranger, Second grade	Permanent.
M. Shams-ud-din Sahib	Salem	Do. Fourth grade.	Do. Third grade.	Do.
M. R. Ry. C. Subramania Aiyer.	Nellore	Do. do.	Do. do.	Sub. <i>pro tem.</i>

19th July 1899.—*Appointment*.—M. R. Ry. V. Subramania Aiyer, M. A., to be Ranger, Sixth Grade, on probation, in the Salem district,

No.	Name of Officer.	District.	Nature of charge.	Remarks.
1	Mr J. L. MacC. O'Leary.	Trichinopoly cum Tanjore	Acting District Forest Officer.	To join on relief by Mr. Cowley-Brown.

26th July, 1899.—*Leave*.—M. R. Ry. A. Subba Rao, Ranger, 5th grade, North Arcot district, is granted privilege leave under article 291 of the Civil Service Regulations for one month from date of relief.

27th July, 1899.—Leave.—The nine months' and fifteen days' leave on medical certificate under article 369 of the Civil Service Regulations granted to Mr. C. P. Howell, Forest Ranger, 1st grade, South Coimbatore Division in S. O. Nos. 41 and 202 of 1898-99, and published in the *Fort St. George Gazette* Part II, dated 27th June 1899, page 860, is further extended by one month and a half.

3—BOMBAY GAZETTE.

5th July, 1899.—No. 4652.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. Ardeshir Nasarvánji Master, L.C.E., to be Extra Assistant Conservator of Forests, 2nd grade.

Mr. Abdul Rasul Khajbáksh to be Extra Assistant Conservator of Forests, 3rd grade.

Mr. Bajbhai Jadhavbhái Patel, L.C.E., to be Extra Assistant Conservator of Forests, 4th grade, and to be Assistant to the Divisional Forest Officer, Násik.

5th July, 1899.—No. 4653.—Mr. R. S. Fagan, Deputy Conservator of Forests, 2nd grade, has been allowed by her Majesty's Secretary of State for India to return to duty within the period of his leave.

6th July 1899.—No. 1018.—Messrs. A. G. Edie and J. Dodgson, acting Deputy Conservators of Forests, 4th grade, respectively delivered over and received charge of the Divisional Forest office, North Tháns, on the 1st July 1899, in the forenoon.

7th July, 1899.—No. 4714.—Mr. L. S. Osmaston, Deputy Conservator of Forests, 3rd grade, and Divisional Forest Officer, Working Plans, Central Circle, is granted privilege leave of absence for two months and twenty-seven days from or after the 29th instant.

8th July, 1899.—No. 2071.—Messrs. W. E. Copleston and E. G. Oliver, Deputy Conservators of Forests, respectively delivered over and received charge of the Belgaum Forest Division in the afternoon of the 29th June 1899.

20th July, 1899.—No. 1942.—Messrs. G. R. Takle and W. R. Govande, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the Sholapur Division in the forenoon of the 11th July 1899.

24th July 1899.—No. 1186.—Mr. J. A. McIver, Forest Demarcation Officer, Dánga, has been relieved of his duties as Demarcation Officer, Dánga, in the afternoon of the 18th instant.

24th July, 1899.—No. 2994.—Messrs. G. P. Millett, Deputy Conservator of Forests, and B. J. Patel, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Sub-Division Office, Násik, on the 15th July 1899, in the afternoon.

26th July, 1899.—No. 5161.—Mr. F. R. Dassai, Conservator of Forests, N. C., is allowed privilege leave of absence for three months with effect from 3rd August 1899.

27th July 1899.—No. 2491.—Messrs. D. A. Thomson, acting Deputy Conservator of Forests, and G. R. Takle, Extra Assistant, respectively delivered over and received charge of the Sub-Division Forest office, Kolába, in the forenoon of the 19th instant.

29th July 1899.—No. 5249.—His Excellency the Governor in Council is pleased to appoint Mr. O. H. L. Napier to hold charge of the office of Divisional Forest Officer, Working Plans, Central Circle, in addition to his own, during the absence of Mr. L. S. Osmaston on leave or pending further orders.

No. 5250.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. G. M. Ryan to hold charge of the office of Conservator of Forests, N. C., during the absence of Mr. Framji Rustamji Dasá on leave or pending further orders.

Mr. Krishnaji Babaji Phadke to hold charge of the office of Divisional Forest Officer, South Thana, vice Mr. G. M. Ryan, pending further orders.

4.—BENGAL GAZETTE.

4th July 1899.—No. 2143.—Six months' leave on medical certificate under article 369 of the Civil Service Regulations, is granted to Babu Guru Das Chatterjee, Extra Assistant Conservator of Forests, attached to the Singhbhum Division, with effect from the afternoon of the 2nd May 1899.

11th July 1899.—No. 2227.—Mr. E. P. Stebbing, Officiating Deputy Conservator of Forests, on transfer from the Chittagong Forest Division, took over charge of the Darjeeling Forest Division, from Mr. C. G. Rogers, Deputy Conservator of Forests, in the afternoon of the 27th June 1899, from which date the services of the latter are placed at the disposal of the Government of India for special duty.

5.—N.-W.P. AND OUDH GAZETTE.

26th July 1899.—No. ²³⁷⁹II-623B.—The undermentioned officers have been granted by Her Majesty's Secretary of State for India permission to return to duty:—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. J. W. Oliver	Forest.	Conservator of Forests.	Within period of leave.

14th July 1899.—No. ²⁶⁵²II-429C.—Babu Raghu Nath Pathak, Extra Assistant Conservator of Forests, attached to the Kheri Division of the Oudh Forest Circle, on being relieved, privilege leave for three months.

18th July 1899.—No. $\frac{2718}{11-59}$ A.T. The following temporary promotions among Forest Officers are notified for general information :—

With effect from,	Consequent	Name.	From	To
25th June 1899.	Mr. F. A. Lest's departure on privilege leave	Mr. H. G. Billson.	Asst. Conservator, 1st grade, <i>Pro v. Sub.</i>	Officiating Dy. Conservator, 4th grade.
27th June 1899.	Mr. L. Mer. Osmanton's departure on privilege leave.	Mr. B. B. Osmanton	Officiating Deputy Conservator, 3rd grade.	Officiating Dy. Conservator, 2nd grade.
		Mr. W. H. Lovegrove	Deputy Conservator, 4th grade.	Officiating Dy. Conservator, 3rd grade.
		Mr. A. C. Milward.	Officiating Assistant Conservator, 1st grade.	Officiating Dy. Conservator, 4th grade.

24th July 1899 —No. $\frac{2770}{11-596}$ C. Mr. F. F. R. Channer, Assistant Conservator of Forests, attached to the Gonda Forest Division, Oudh Forest Circle, privilege leave for two months and twenty-nine days with effect from 17th August 1899.

24th July 1899 —No. $\frac{2771}{11-596}$ C. Mr. H. C. Billson, Assistant Conservator of Forests, attached to the Gorakhpur Forest Division, of the Oudh Circle, to hold charge of the Gonda Forest Division of the same Circle, in addition to his own duties, during the absence on leave of Mr. F. F. R. Channer, or until further orders.

6.—PUNJAB GAZETTE.

8th July 1899.—No. 301.—In consequence of the transfer, with effect from the 1st June 1899, of the head-quarters of the Chenab Forest Division from Gujranwala to Wazirabad, in column 2, opposite entry No. 4 of the tabular statement attached to Punjab Government Notification No. 124 of the 10th of March 1897, for "Gujranwala" read "Wazirabad."

8th July 1899.—No. $\frac{304}{A.L.No.19}$. The following change has taken place in the list of Forest Officers in the Associated Provinces, with effect from the date specified :—

Name.	Present grade.	(Grade to which promoted, or reverted.)	With effect from	REMARKS.
Mr. S. L. Kenny ...	Provisional Asst. Conservator, 1st grade.	Officiating Dy. Conservator, 4th grade.	15th April 1899.	Consequent on the departure of Mr. R. M. Williamson on six months' special leave

7.—CENTRAL PROVINCES GAZETTE.

8th June 1899.—No. 11. Jan Muhammad, Deputy Ranger, 2nd grade, sub. *pro tem.*, Damoh Division at present under suspension and who has absconded in order to avoid arrest on a charge of criminal breach of trust, is dismissed from the Government service with effect from the 18th February 1899.

1st July 1899.—No. 2549.—Mr. A. Hunt, Ranger, 1st grade, is appointed to be an Extra-Assistant Conservator of Forests, 4th grade, with effect from the 22nd December 1898, *vice* Mr. Muhammad Kadir Baksh, Extra-Assistant Conservator of Forests, 2nd grade, deceased, but will continue to be on Foreign Service

3rd July 1899.—No 17.—Leave without pay for two years, granted under article 372 of the Civil Service Regulations, by Departmental Order No. 10, dated the 3rd June 1899, to Temporary Deputy Ranger Rajendra Lal Shawe, Nimar Division, with effect from the 15th June 1899, is hereby cancelled.

5th July 1899.—No 18.—The following changes have taken place in the list of Forest Rangers in the Central Provinces with effect from the date specified against each:—

Name.	Present grade	Grade to which promoted.	With effect from	Remarks.
Mr. S. R. Parsons.	Ranger, 1st grade, sub. <i>pro tem.</i>	Ranger, 1st grade.	22nd Decr. /98	Consequent on the appointment of Mr. A. Hunt,
„ J. F. Anthony.	Ranger, 2nd grade, sub. <i>pro tem.</i>	Ranger, 2nd grade	Do.	Ranger, 1st grade, as Extra Assistant
„ R. N. Thompson.	Ranger, 3rd grade, sub. <i>pro tem.</i>	Ranger, 3rd grade.	Do.	Conservator of Forests, 4th grade.
„ W. G. Slaney.	Ranger, 4th grade, sub. <i>pro tem.</i>	Ranger, 4th grade.	Do.	
N. C. Chatterjee.	Ranger, 3rd grade, sub. <i>pro tem.</i>	Ranger, 3rd grade.	4th June 1899.	Consequent on the retirement of Muhammad Yasin,
Mr. W. J. Anthony.	Ranger, 4th grade.	Ranger, 3rd grade, sub. <i>pro</i>	Do.	3rd grade, from Government service.
Shyam Sunder.	Ranger, 5th grade.	Ranger, 4th grade.	Do.	
• Govind Gangadhar Sapro.	Ranger, 5th grade.	Ranger, 5th grade.	Do.	

Departmental Order No. 14, dated the 16th June 1899, published in the *Central Provinces Gazette*, dated the 1st July 1899, is hereby cancelled.

4th July, 1899.—No. 2581.—On completion of the special temporary duty on which he is engaged in the Bastar Feudatory State, Mr. A. W. Blunt, Deputy Conservator of Forests, is placed on special duty in the Raipur Forest Division.

10th July, 1899.—No. 19.—Balkrishna D. Ukiqwe, Ranger, 6th grade, Southern Circle, is promoted to Ranger, 5th grade, with effect from the 7th June 1899, to fill an existing vacancy.

10th July 1899.—No. 20.—Shiv Parshad, Deputy Ranger, 2nd grade, sub *pro tem*, attached to the Hoshangabad Division, is confirmed in that grade with effect from the 1st July 1899.

10th July 1899.—No. 21.—Privilege leave for one month, under article 291 of the Civil Service Regulations, is granted to Suiyid Naki Rana, Deputy Ranger, Permanent Establishment, Narsinghpur Division, with effect from the 21st July 1899, or such subsequent date as he may be permitted to avail himself of it.

11th July, 1899.—No. 22.—The resignation of his appointment as temporary Deputy Ranger on Rs 35 per mensem tendered by Rajendra Lal Shawe is accepted, with effect from the 12th June 1899, the date on which he absented himself from duty.

18th July, 1899.—No. 2784.—Privilege leave for three months, under article 291 of the Civil Service Regulations, is granted to Mr. A. St. V. Beechey, Officiating Deputy Conservator of Forests, with effect from the date on which he may be relieved of the charge of the Sambalpur Forest Division.

18th July, 1899.—No. 2735.—Mr. Narayan Parshad Bajpai, Extra Assistant Conservator of Forests, in temporary charge of the Direction Division, Southern Circle, Central Provinces, is directed to hold charge of the Sambalpur Forest Division during the absence on privilege leave of Mr. A. St. V. Beechey, or until further orders.

14th July, 1899.—No. 2753.—Furlough for one year and three months, under article 340 (b) of the Civil Service Regulations, is granted to Mr. A. W. Blunt, Deputy Conservator of Forests, with effect from the date of completion of his special duties in the Raipur Forest Division.

19th July, 1899.—No. 28.—Privilege leave for two months, under article 291 of the Civil Service Regulations is granted to Deputy Ranger Sheikh Haidar, Permanent Establishment, Nimar Division, with effect from the 25th July 1899, or such subsequent date as he may be permitted to avail himself of it.

8.—BURMA GAZETTE.

30th June, 1899.—No. 18.—Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, was relieved of the charge of the 'Promo' Division by Mr. A. Rodger, Assistant Conservator of Forests, on the afternoon of the 29th June 1899.

3rd July, 1899.—No. 240.—The following alterations in rank are ordered in the Forest Department:—

- (1) With effect from the 11th February 1899, consequent on the appointment of Mr. J. Nisbet as Conservator, 3rd grade :
 - Mr. H. B. Ward, Deputy Conservator, 1st grade, substantive provisional, to be confirmed in that grade.
 - Mr. A. Weston, Deputy Conservator, 2nd (officiating 1st) grade, to be Deputy Conservator, 1st grade, substantive provisional.
 - Mr. H. B. Anthony, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade.
 - Mr. H. Calthrop, Deputy Conservator, 2nd grade, substantive provisional, to be confirmed in that grade.
 - Mr. C. E. Muriel, Deputy Conservator, 3rd (officiating 2nd) grade, to be Deputy Conservator, 2nd grade, substantive provisional.
 - Mr. G. F. R. Blackwell, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.
 - Mr. H. N. Thompson, Deputy Conservator, 3rd grade, substantive provisional, to be confirmed in that grade.
 - Mr. G. R. Long, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.
 - Mr. A. M. Burn-Murdoch, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade and to officiate in the 3rd grade.
 - Mr. F. Linnell, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to be a Deputy Conservator, 4th grade, substantive provisional.
- (2) With effect from the 18th March 1899, consequent on the departure on privilege leave of Mr C. W. A. Bruce, Deputy Conservator, 4th grade :
 - Mr. G. E. S. Cubitt, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.
- (3) With effect from the 23rd April 1899, consequent on the death of Mr. G. Q. Corbett, Deputy Conservator of Forests, 3rd grade :
 - Mr. M. Hill, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.
 - Mr. A. P. Grenfell, Deputy Conservator, 3rd grade, substantive provisional, to be confirmed in that grade.
 - Mr. W. T. T. McHarg, Deputy Conservator, 4th (officiating 3rd) grade, to be Deputy Conservator, 3rd grade, substantive provisional.
 - Mr. H. H. Forteath, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.
 - Mr. S. Carr, Deputy Conservator, 4th grade, substantive provisional, to be confirmed in that grade.
 - Mr. C. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to be Deputy Conservator, 4th grade, substantive provisional.

Mr. A. H. M. Lawson, Assistant Conservator, 1st grade, substantive provisional, to be confirmed in that grade and to officiate as Deputy Conservator, 4th grade.

Mr. H. W. A. Watson, Assistant Conservator, 2nd grade, and officiating Assistant Conservator, 1st grade, to be Assistant Conservator, 1st grade, substantive provisional.

4th July 1899.—No. 83.—Mr. C. W. A. Bruce, Deputy Conservator of Forests, reported his return from the three months' and 15 days' privilege leave granted him in Revenue Department Notification No 71 (Forests), dated the 21st February 1899, and received charge of the Pyinmana Forest division from Mr. C. W. Doveton, officiating Deputy Conservator of Forests, on the afternoon of the 1st instant.

4th July 1899.—No 84.—Under the provisions of article 282 (i) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. C. W. Doveton, officiating Deputy Conservator of Forests, with effect from the 18th July 1899, or the date on which he may avail himself of it.

11th July 1899.—No. 14.—Mr. A. Rodger, Assistant Conservator of Forests, was relieved of the charge of the Prome division by Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, on the forenoon of the 9th July 1899.

14th July 1899.—No. 7.—With reference to Revenue Department Notification No. 208 (Forests), dated the 31st May 1899, Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, made over charge of the Magwe subdivision to Mr. C. E. Muriel, Deputy Conservator of Forests, on the afternoon of the 8th July 1899, and availed himself of the three months' and 15 days' privilege leave granted in the above notification.

15th July 1899.—No. 34.—With reference to Revenue Department Notification No. 244 (Forests), dated the 4th July 1899, Mr. C. W. Doveton, officiating Deputy Conservator of Forests, availed himself of the three months' and 15 days' privilege leave on the 13th instant.

20th July 1899.—No. 265.—Mr. J. J. Rorie, Assistant Conservator of Forests, Personal Assistant to the Conservators of Forests, Eastern and Western Circles, is transferred from Mandalay to Toungoo.

20th July 1899.—No. 267.—Mr. A. Lawrence, Assistant Conservator of Forests, is transferred from Shwebo to Pakókku and is placed in charge of the Gangaw subdivision, Yaw Forest division.

20th July 1899.—No. 268.—Mr. S. E. F. Jenkins, Extra Assistant Conservator of Forests, is transferred from Gangaw to the charge of the Magwe subdivision, Minbu Forest division.

20th July 1899. No. 269.—On his return from leave Mr. G. T. Wrafter, Extra Assistant Conservator of Forests, is posted to the charge of the Kindat subdivision, of the Upper Chindwin Forest division.

20th July 1899.—No. 8.—With reference to Revenue Department Notification No. 235 (Forests), dated the 27th June 1899, Mr. G. K. Parker, Assistant Conservator of Forests, made over, and Mr. C. M. Hodgson, Deputy Conservator of Forests, received charge of the Homa-lin subdivision on the forenoon of the 9th July 1899.

21st July, 1899.—No. 15.—Maung Tha Kado, Extra Assistant Conservator of Forests, was relieved of his duties in the Pegu Division on the forenoon of the 15th July 1899, and availed himself on the

EXTRACTS FROM OFFICIAL GAZETTES.

date of three months' privilege leave granted him in Revenue Department Notification No. 211 (Forests), dated the 20th June 1899.

24th July, 1899.—No. 16.—Mr M. Hill, Deputy Conservator of Forests, was relieved of the charge of the Agency Division by Mr. H. S. Ker-Edie, Deputy Conservator of Forests, on the afternoon of the 24th July 1899.

27th July, 1899.—No. 272.—On his return from Dehra Dun, Mr. S. Carr, Deputy Conservator of Forests, is appointed to the charge of No. 11 Working Plans Division, *vice* Mr. C. W. Doveton, Assistant Conservator of Forests, proceeding on leave.

27th July, 1899.—No. 280.—Mr S. Carr is appointed to the charge of No. 1 Working Plans Division, with headquarters at Pynmana, in addition to his other duties.

27th July, 1899.—No. 281.—On relief by Mr S. Carr, Mr. F. H. Todd, Assistant Conservator of Forests, is transferred from Pynmana to Tonngoo.

27th July, 1899.—No. 282.—Mr M. Hill, Deputy Conservator of Forests, is transferred from Rangoon and posted to the charge of the Bhamo Forest Division, *vice* Mr. S. Carr, Deputy Conservator of Forests, transferred.

27th July, 1899.—No. 283.—Mr. H. S. Ker-Edie, Deputy Conservator of Forests is appointed to the charge of the Agency Division Pegu Circle, in addition to his other duties, *vice* Mr M. Hill, Deputy Conservator of Forests, transferred.

9.—ASSAM GAZETTE

4th July 1899.—No. 5248G.—With effect from the 2nd July 1899, Babu Tara Kisor Gupta, Extra Assistant Conservator, 2nd grade, to be Extra Assistant Conservator, First grade.

10.—HYDERABAD RESIDENCY GAZETTE.

Nil.

11.—MYSORE GAZETTE.

14th July 1899.—No. 348 Ft F. 1-96.—Under Article 188 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests, Shimoga district, is granted privilege leave of absence for 15 days, with effect from the 27th June 1899.

14th July 1899.—No. 445 —Ft. F. 1-96—Under Article 177 of the Mysore Service Regulations, Mr P. E. Benson, Sub-Assistant Conservator of Forests, Shimoga district, was granted casual leave of absence for five days, with effect from the 4th June 1899.

20th July 1899.—No. 627.—Ft F. 27-95.—The following promotions of Forest Officers are sanctioned :—

T. Abdul Karim, from acting Deputy Conservator, 1st class, to permanent Deputy Conservator, 1st class ;

Mr. V. Narayana Row, from acting Deputy Conservator, 2nd class, to permanent Deputy Conservator, 2nd class ;

Mr. S. Bapu Row, from acting Assistant Conservator, 3rd class, to permanent Deputy Conservator, 3rd class ;

Mr. M. Veekatnarnappa, from acting Deputy Conservator, 1st class, to permanent Assistant Conservator, 1st class ;

Mr. C. Appara, from acting Assistant Conservator, 2nd class, to permanent Assistant Conservator, 2nd class ;

These promotions taking effect from 16th January 1899.

Mr. K. Shamiengar, from Sub-Assistant Conservator, to permanent Assistant Conservator, 3rd class, with effect from date of this order.

Mr. H. Srinivasa Row, from Sub-Assistant Conservator, *sub pro tem*, to permanent Sub-Assistant Conservator, with effect from 8th June 1898.